Brief description of the database of light backscattering of cirrus clouds' ice crystals, level 2

Note: This database is based on "the database of light backscattering of cirrus clouds' ice crystals, level 1". The level 2 database is the same as the level 1 database but it contains the Mueller matrixes for the case of **randomly oriented crystals**.

(The level 1 database contains matrix of light scattering for particle that are averaged over only two Euler angles.)

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1.General characteristics

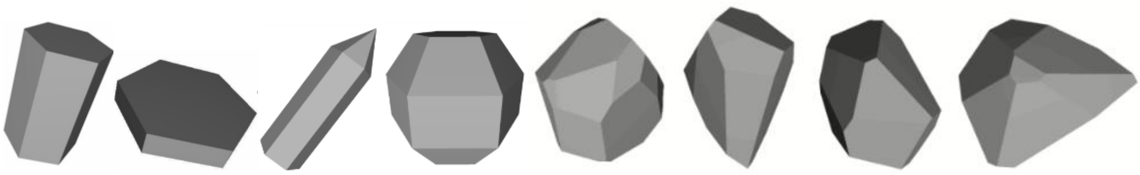
1.1 The main wavelengths and the refractive indices of ice:

- λ = 0.355 μm, n = 1.3249
- λ = 0.532 μm, n = 1.3116
- λ = 1.064 μm, n = 1.3004 + i·0.0000019
- λ = 2.15 μm, n = 1.2663 + i·0.000403
- λ = 2 μm, n = 1.2744 + i·0.00164
- λ = 1.55 μm, n = 1.2893 + i·0.000424

The additional wavelengths and the refractive indices:

- λ = 1.064 μm, n = 1.6 + i·0.002
- λ = 1.064 μm, n = 1.6
- λ = 0.532 μm, n = 1.48 +i·0.002
- λ = 0.532 μm, n = 1.48

1.2 The particle's shape.



From left to right:

1. Hexagonal column
2. Hexagonal plate
3. Bullet
4. Droxtal
5. Arbitrary shape particle №1
6. Arbitrary shape particle №2
7. Arbitrary shape particle №3
8. Arbitrary shape particle №4

1.3 Definition of the particle shapes.

1) The hexagonal plate and column are defined by the diameter *D* and the length *L* according to: *A.H. Auer* and *D.L. Mitchell:*

[*Auer A.H., Veal D.L. The dimension of ice crystals in natural clouds // J. Atmos. Sci. 1970. V. 29. P. 311–317.*]

[*Mitchell D.L., Arnott W.P. A model predicting the evolution of ice particle size spectra and radiative properties of cirrus clouds. Part II: Dependence of absorption and extinction on ice crystal morphology // J. Atmos. Sci. 1994. V. 51. P. 817–832.*]

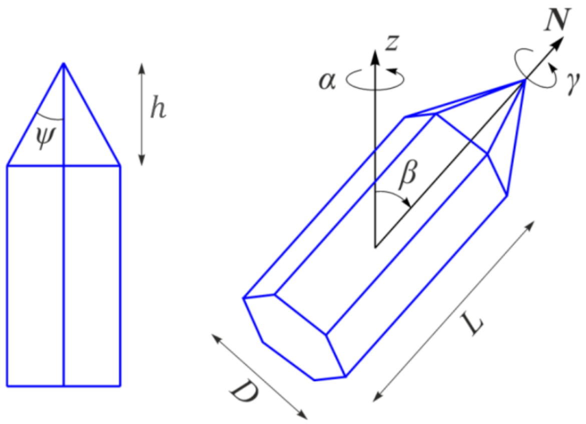
For column:

$$D = \begin{cases} 0.7L, & 10 < L < 100 \\ 6.96\sqrt{L}, & 100 \le L \le 1000 \end{cases}$$ where ***L*** is the crystal height, ***D*** is the crystal width.

For plate:

$$L = 2.0202 * D^{0.449},$$ where ***L*** is the crystal height, ***D*** is the crystal width.

2) The bullet shape is defined by the diameter *D*, the length of a hexagonal part *L* and the angle of a tip *ψ=62°*.

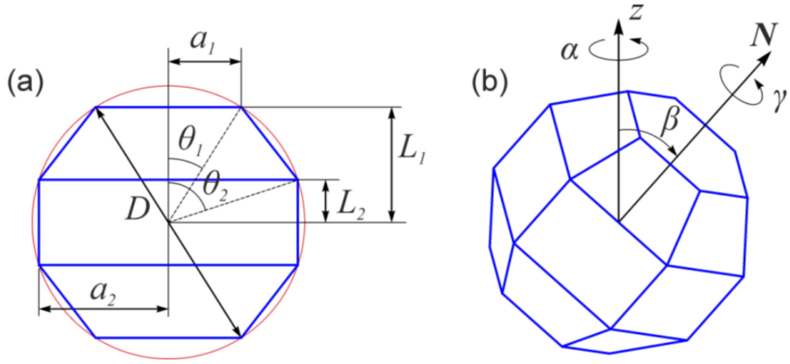


The size of bullets is defined similar to column, but a tip with a height of ***h*** is added to the hexagonal prism.

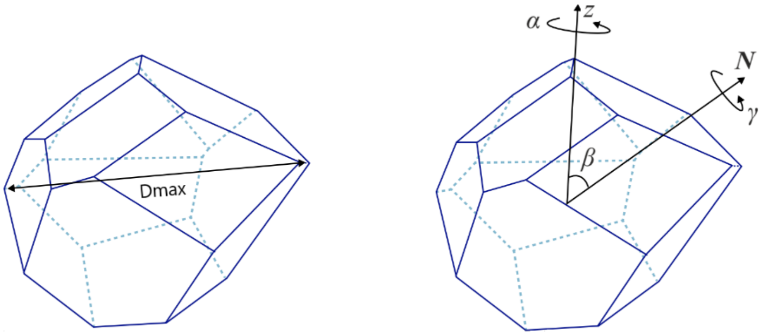
$$D = \begin{cases} 0.7L, & 10 < L < 100 \\ 6.96\sqrt{L}, & 100 \le L \le 1000 \end{cases}$$ where ***L*** is the crystal height, ***D*** is the crystal width.

$$h = \frac{\sqrt{3}*D*tg(62°)}{4}$$ is the height of the tip on the bullet

3) The droxtal shape is defined by the diameter *D*. The two angles θ_1 and θ_2 are set as θ_1 =32.35° and θ_2 =71.81° [P. Yang et al., J. Quant. Spectrosc. Radiat. Transfer, 79–80, P. 1159–1169 (2003)]:



4) Arbitrary shape particle is specified by the maximum size (D_{max}) between the vertices of the crystal. The coordinates of vertexes of the particle are given in a separate file, then the particles are simply scaled to the given D_{max}.



1.4 Averaging over particle orientation.

In this database we assume that the particles have a random spatial orientation. The average Mueller matrix can be found as:

$$\langle M(D)\rangle = \int_{\alpha}\int_{\beta}\int_{\gamma} M(\alpha,\beta,\gamma,D) sin\beta d\gamma d\beta d\alpha$$

The orientation of the particle is specified by three Euler angles, where **α** defines rotation about the vertical direction, **β** is the angle between the vertical direction and the crystal main axis, **γ** describes rotation about the main axis; **D** is the particle size.

The averaging over the **α** angle can be done analytically, while averaging over the **β** and **γ** angles requires numerical integration. We choose the appoprient number of orientation for this numerical integration accordant to our estimation [*A. Konoshonkin, A. Borovoi, N. Kustova, H. Okamoto, H. Ishimoto, Y. Grynko, and J. Förstner, "Light scattering by ice crystals of cirrus clouds: From exact numerical methods to physical-optics approximation," Journal of Quantitative Spectroscopy and Radiative Transfer 195, 132–140 (2017).*]

This estimate requires the total number of orientations by angle **β** and angle **γ** as many as the angular step is twice less than

$$\xi = 0.69\frac{\lambda}{l_{\max}}.$$

where l_{max} is maximum edge length in a particle

On the basis of which the minimum step in the angles of orientation of the particle was chosen according to

$$\Delta\beta, \Delta\gamma < \frac{\xi}{2},$$

1.5 Basic relations

$CS = A/4$	is a particle cross section, A is the particle surface area.
$LR = \frac{2*CS}{M_{11}}$	is the lidar ratio
$LDR = \frac{M_{11} - M_{22}}{M_{11} + M_{22}}$	is the linear depolarization ratio
$CDR = \frac{M_{11} + M_{44}}{M_{11} - M_{44}}$	is the circular depolarization ratio
$m_{14} = M_{14}/M_{11} \ldots m_{44} = M_{44}/M_{11}$	are the normalized elements of the Muller matrix

The database consists of 16 elements, where the nonzero elements are: M_{11}, M_{22}, M_{33}, M_{44}. The value of the elements M_{14} and M_{41} is close to zero. The difference of the value of the elements M_{14} and M_{41} from the 0 for plates, columns, bullets and droxtals shows the inaccuracy (calculation error):

$$\begin{bmatrix} M_{11} & 0 & 0 & M_{14} \\ 0 & M_{22} & 0 & 0 \\ 0 & 0 & M_{33} & 0 \\ M_{41} & 0 & 0 & M_{44} \end{bmatrix}$$

2.The parameters of the database

2.1. Hexagonal column (table 1)

Particle shape	*L* (microns)	Wavelength (microns)	Real part of refractive index	Imaginary part of refractive index	Number of refractions	Number of orientations (β, γ)	Step
Hexagonal column	5 - 59.9	All wavelengths			14	815x407	0.1 (550 discret)
	60 - 98.6	0.355	1.3249	0	12		0.1 (387 discret)
	60 - 98.7	0.532	1.48				0.1 (388 discret)
				0.002			
	60 - 98.5		1.3116	0			0.1 (386 discret)
		1.55	1.2893	0.000424			
	60 - 98.8	1.064	1.6	0			0.1 (389 discret)
	60 - 98.7			0.002			0.1 (388 discret)
	60 - 98.8		1.3004	0.0000019			0.1 (389 discret)
	60 - 98.5	2	1.2744	0.00164			0.1 (386 discret)
	60 - 98.9	2.15	1.2663	0.000403			0.1 (390 discret)
	100	0.355	1.3249	0	11	paragraph (1.4)	98.6702 - 98.8712 (64 discret)
		0.532	1.48				98.778 - 98.922 (9 discret)
				0.002			98.644 - 99.04 (23 discret)
			1.3116	0			98.498 - 98.876 (22 discret)
		1.55	1.2893	0.000424			98.078 - 99.222 (45 discret)
		1.064	1.6	0			98.804 - 99.076 (18 discret)
				0.002			98.452 - 99.188 (24 discret)
			1.3004	0.0000019			98.82 - 99.16 (18 discret)
		2	1.2744	0.00164			98.266 - 99.824 (42 discret)
		2.15	1.2663	0.000403			97.8 - 99.4 (51 discret)
	160	0.355	1.3249	0			159.1 - 160.255 (22 discret)
		0.532	1.48				159.5 - 160.2 (21 discret)
				0.002			159.2 - 160.1 (21 discret)
			1.3116	0			159.6 - 160.5 (21 discret)
		1.55	1.2893	0.000424			159 - 161.5 (21 discret)
		1.064	1.6	0			159 - 160.4 (21 discret)
				0.002			158.8 - 160.3 (21 discret)
			1.3004	0.0000019			158.6 - 160.2 (21 discret)
		2	1.2744	0.00164			157.8 - 161.1 (21 discret)
		2.15	1.2663	0.000403			159.1 - 162.5 (21 discret)

Table 1 – Continuation of Table 1.

Particle shape	*L* (microns)	Wavelength (microns)	Real part of refractive index	Imaginary part of refractive index	Number of refractions	Number of orientations (β, γ)	Step
Hexagonal column	250	0.355	1.3249	0	11	paragraph (1.4)	249.5 - 250.2 (21 discret)
		0.532	1.48				249.3 - 250.1 (21 discret)
				0.002			250 - 250.7 (21 discret)
			1.3116	0			249.6 - 250.7 (21 discret)
		1.55	1.2893	0.000424			249.8 - 252.9 (21 discret)
		1.064	1.6	0			249 - 250.7 (21 discret)
				0.002			249.5 - 251.39 (22 discret)
			1.3004	0.0000019			249 - 251.3 (21 discret)
		2	1.2744	0.00164			249.665 - 254 (17 discret)
		2.15	1.2663	0.000403			247 - 250.8 (21 discret)
	400	0.355	1.3249	0			399.7 - 400.6 (21 discret)
		0.532	1.48				399.2 - 400.5 (21 discret)
				0.002			399.95 - 400 (21 discret)
			1.3116	0			399.4 - 400.8 (21 discret)
		1.55	1.2893	0.000424			397.7 - 401.5 (21 discret)
		1.064	1.6	0			398.6 - 401 (21 discret)
				0.002			398.7 - 401 (21 discret)
			1.3004	0.0000019			398.2 - 401 (21 discret)
		2	1.2744	0.00164			396.2 - 401.5 (21 discret)
		2.15	1.2663	0.000403			397 - 402.8 (21 discret)
	630	0.355	1.3249	0			629.6 - 630.7 (21 discret)
		0.532	1.48				629.7 - 630.9 (21 discret)
				0.002			629.6 - 629.8 (21 discret)
			1.3116	0			629.3 - 631 (21 discret)
		1.55	1.2893	0.000424			627.5 - 632.6 (21 discret)
		1.064	1.6	0			629 - 631.6 (21 discret)
				0.002			628.6 - 631.4 (21 discret)
			1.3004	0.0000019			629 - 632.3 (21 discret)
		2	1.2744	0.00164			627.5 - 632.5 (21 discret)
		2.15	1.2663	0.000403			627 - 633 (21 discret)
	1000	0.355	1.3249	0			1000 (1 discret)
		0.532	1.48				1000 (1 discret)
				0.002			999 - 1000.95 (31 discret)
			1.3116	0			1000 (1 discret)
		1.55	1.2893	0.000424			997 - 1003 (31 discret)
		1.064	1.6	0			1000 (1 discret)
				0.002			1000 (1 discret)
			1.3004	0.0000019			1000 (1 discret)
		2	1.2744	0.00164			996 - 1003.98 (31 discret)
		2.15	1.2663	0.000403			995.5 - 1004.5 (31 discret)

2.2. Hexagonal plate (table 2)

Particle shape	*D* (microns)	Wavelength (microns)	Real part of refractive index	Imaginary part of refractive index	Number of refractions	Number of orientations (β, γ)	Step
Hexagonal plate	5-59.9	0.355	1.3249	0	8	815x407	0.1 (550 discret)
		0.532	1.48				
			1.3116				
		1.064	1.6				
		0.532	1.48	0.002		715x357	
		1.064	1.6				
			1.3004	0.0000019			
		1.55	1.2893	0.000424			
		2	1.2744	0.00164			
		2.15	1.2663	0.000403			
	60 - 100	0.355	1.3249	0	12	815x407	0.1 (401 discret)
		0.532	1.48				
			1.3116				
		1.064	1.6				
			1.3004	0.0000019			
		0.532	1.48	0.002			
		1.55	1.2893	0.000424			
		1.064	1.6	0.002			
		2	1.2744	0.00164			
		2.15	1.2663	0.000403			
	102.2674 - 149.7163	0.355	1.3249	0		paragraph (1.4)	log step (18 discret)
		0.532	1.48				
			1.3116				
		1.064	1.6				
			1.3004	0.0000019			
	101 - 150		1.6	0.002			1 (50 discret)
		0.532	1.48				
		1.55	1.2893	0.000424			
		2	1.2744	0.00164			
		2.15	1.2663	0.000403			
	150-295	0.355	1.3249	0	16		5 (30 discret)
		0.532	1.48				
			1.3116				
		1.064	1.6				
			1.3004	0.0000019			
	151 - 299		1.6	0.002			1 (149 discret)
		0.532	1.48				
		1.55	1.2893	0.000424			
		2	1.2744	0.00164			
		2.15	1.2663	0.000403			
	300 - 611.7586	0.355	1.3249	0	24		log step (30 discret)
		0.532	1.3116				
	626.9763 - 1000	0.355	1.3249		29		log step (20 discret)
		0.532	1.3116				
	300 - 1000		1.48		20		log step (50 discret)
		2.15	1.2663	0.000403			
		0.532	1.48	0.002			
		1.55	1.2893	0.000424			
		2	1.2744	0.00164			
		1.064	1.6	0	29		
				0.002			
			1.3004	0.0000019			log step (129 discret)

2.3. Arbitrary shape particle (table 3)

Particle shape	D_{max} (microns)	Wavelength (microns)	Real part of refractive index	Imaginary part of refractive index	Number of refractions	Number of orientations (β, γ)	Step
Arbitrary shape particle №1	5 - 20	All wavelengths			8	400x200	0.2 (79 discret)
						815x407	(3 discret)
	20.6 - 85.1						log step(8 discret)
	100 -300					paragraph (1.4)	(25 discret)
Arbitrary shape particle №2	5 - 27.9					180x361	(27 discret)
	29.4 - 94.2					paragraph (1.4)	(21 discret)
	100 - 300						(25 discret)
Arbitrary shape particle №3	5 - 27.9					180x361	(27 discret)
	29.4 - 94.2					paragraph (1.4)	(21 discret)
	100 - 300						(25 discret)
Arbitrary shape particle №4	5 - 27.9					180x361	(27 discret)
	29.4 - 94.2					paragraph (1.4)	(21 discret)
	100 - 300						(25 discret)

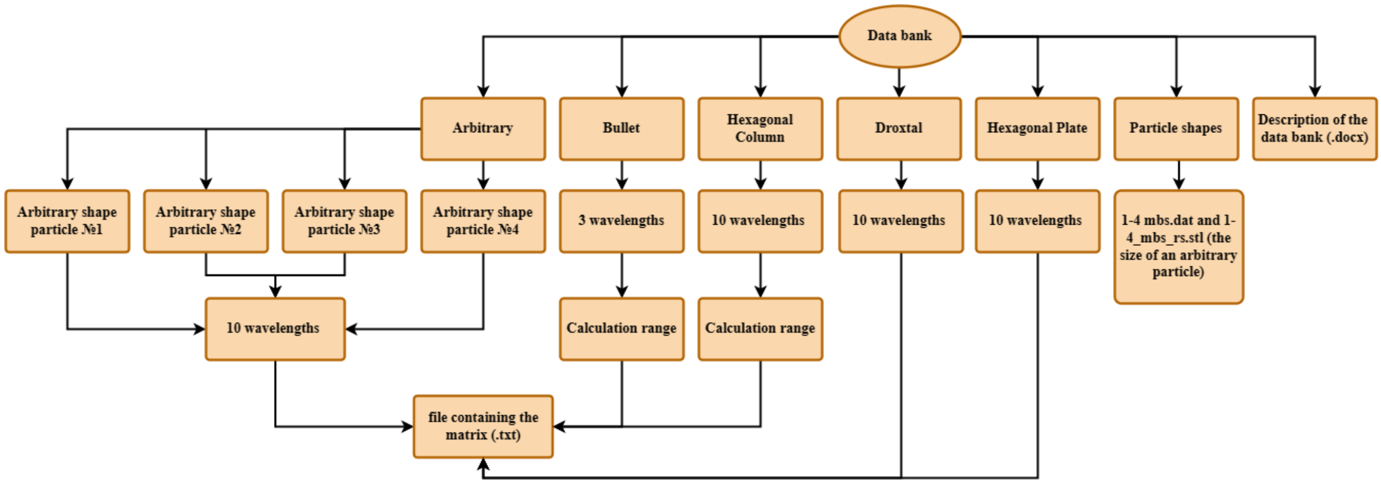
2.4. Droxtal (table 4)

Particle shape	D_{max} (microns)	Wavelength (microns)	Real part of refractive index	Imaginary part of refractive index	Number of refractions	Number of orientations (β, γ)	Step
Droxtal	10 - 100	1.064	1.6	0	10	paragraph (1.4)	0.05 (901 discret)
		All other wavelengths					0.1 (451 discret)
	100.10-199.9	1.064	1.6	0			0.05 (999 discret)
	102 - 198	0.532	1.48	0.002			1 (49 discret)
		1.064	1.6				
	102 -198	2	1.2744	0.00164			1 (49 discret)
	100.8 - 199.2	0.355	1.3249	0			0.4 (124 discret)
		0.532	n1.48				
			1.3116				
		1.064	1.3004	0.0000019			
		1.55	1.2893	0.000424			
		2.15	1.2663	0.000403			
	200 -300	1.064	1.6	0			0.05 (1001 discret)
		0.532	1.48	0.002			5 (11 discret)
		1.064	1.6				
	-	2	1.2744	0.00164	see in additional points for droxtal		
	200 - 300	0.355	1.3249	0	10	paragraph (1.4)	1 (51 discret)
		0.532	1.3116	0			
		1.064	1.3004	0.0000019			
		0.532	1.48	0			
		1.55	1.2893	0.000424			
		2.15	1.2663	0.000403			
	300.10 - 400	1.064	1.6	0			0.05 (1000 discret)
	310 - 400	0.532	1.48	0.002			5 (10 discret)
		1.064	1.6				
	300 - 400	2	1.2744	0.00164			0.1 (501 discret)
	302 - 400	0.355	1.3249	0			1 (50 discret)
		0.532	1.3116				
		1.064	1.3004	0.0000019			
		0.532	1.48	0			
		1.55	1.2893	0.000424			
		2.15	1.2663	0.000403			
Additional points for droxtal	10 - 160	1.064	1.6	0.002			Random (749 discret)
	10.1016 - 299.904	2	1.2744	0.00164			Random (1450 discret)
	200 - 400	2.15	1.2663	0.000403			Random (250 discret)

2.5. Bullet (table 5)

Particle shape	*L* (microns)	Wavelength (microns)	Real part of refractive index	Imaginary part of refractive index	Number of refractions	Number of orientations (β, γ)	Step
Bullet	10 -100	0.355	1.3249	0	12	paragraph (1.4)	0.1 (901 discreteт)
		0.532	1.3116				
		1.064	1.3004	0.0000019			
	160	0.355	1.3249	0	11		157.5 - 162.5 (51 discret)
		0.532	1.3116				157.5 - 162.5 (51 discret)
		1.064	1.3004	0.0000019			157.5 - 162.5 (51 discret)
	250	0.355	1.3249	0			249 - 251.03 (30 discret)
		0.532	1.3116				249 - 251.03 (30 discret)
		1.064	1.3004	0.0000019			248.5 - 251.5 (41 discret)
	400	0.355	1.3249	0			399 - 400.95 (40 discret)
		0.532	1.3116				399 - 400.95 (76 discret)
		1.064	1.3004	0.0000019			397.5 - 401.23 (55 discret)
	630	0.355	1.3249	0			629 - 631.04 (31 discret)
		0.532	1.3116				629 - 631.04 (31 discret)
		1.064	1.3004	0.0000019			627.5 - 632.54 (43 discret)
	1000	0.355	1.3249	0			(1 discret)
		0.532	1.3116				
		1.064	1.3004	0.0000019			

3. General structure of the data bank



3.1. File structure

lmd is the wavelength	**LDR** is the linear depolarization ratio
n is the real part of refractive index	**k** is the imaginary part of refractive index
V is the particle volume	**CS** is the cross section
M_{11}…M_{44} are the elements of the Mueller matrix	m_{14} ... m_{44} are the normalized elements of the Mueller matrix (M_{14}/M_{11}…M_{44}/M_{11})
L is the crystal height	**D** is the crystal width
Dm, Dmax are the maximum particle sizes	**LR** is the lidar ratio
CDR is the circular depolarization	

3.1.1 Hexagonal column

• The final names of the subfolders include:

Wavelength (lmd), the real part of refractive index (n), the imaginary part of refractive index (k).

Example: lmd0.355_n1.3249_k0 means that the wavelength is 0.355, the real part of refractive index (n) is 1.3249, the imaginary part of refractive index (k) is 0.

• For hexagonal columns, the file names have the following format:

`[Name of file]_[Wavelength]_[Real part of refractive index ]_[Imaginary part of refractive index]_[Calculation range in microns].`

Example: "Column_output_lmd0.355_n1.3249_k0 (range 5-100 microns)" means that the file name "Column_output", the wavelength is 0.355, the real part of refractive index (n) is 1.3249, the imaginary part of refractive index (k) is 0, the calculation ranges 5 to 100 microns.

• Data files have the following structure:

`[Column width D] [Column height L] [Dmax] [V] [CS] [LR] [LDR] [CDR] [M11] [M14] [M22] [M33] [M41] [M44] [m14] [m22] [m33] [m41] [m44]`

Example:

D	L	Dmax	V	CS	LR	LDR	CDR	M11	M14	M22	M33	M41	M44	m14	m22	m33	m41	m44
3.5	5	6.103278	39.78304	17.1033	51.999	0.289389	0.621318	0.657832	-0.00013	0.362546	-0.36255	0.000396	-0.15365	-0.00019	0.551122	-0.55112	0.000602	-0.23356

For hexagonal column and bullet, the range from 100 to 1000 with nodal points (160, 250,400, 630 and 1000 microns) was calculated. This was necessary to speed up the calculations. The final result is located in a folder called "Averaged". The result *for the nodal point was taken from averaging the range around the nodal point. The size range around the nodal point is also represented in folders named "Range 160 microns", "Range 250 microns", etc.*

3.1.2 Hexagonal plates

• The final names of the subfolders include:

Wavelength (lmd), the real part of refractive index (n), the imaginary part of refractive index (k).

Example: lmd0.355_n1.3249_k0 means that the wavelength is 0.355, the real part of refractive index (n) is 1.3249, the imaginary part of refractive index (k) is 0.

• For hexagonal plates, the file names have the following format:

`[Name of file]_[Wavelength]_[Real part of refractive index ]_[Imaginary part of refractive index]`

Example: "Plate_output_lmd0.355_n1.3249_k0" means that the file name “`Plate_output`”, the wavelength is 0.355, the real part of refractive index (n) is 1.3249, the imaginary part of refractive index (k) is 0.

• Data files have the following structure:

`[Plate width D] [Plate height L] [Dmax] [V] [CS] [LR] [LDR] [CDR] [M11] [M14] [M22] [M33] [M41] [M44] [m14] [m22] [m33] [m41] [m44]`

Example:

D	L	Dmax	V	CS	LR	LDR	CDR	M11	M14	M22	M33	M41	M44	m14	m22	m33	m41	m44
5	4.16	6.504276	67.54998	23.71899	52.27924	0.285127	0.669081	0.907396	0.001649	0.504754	-0.50475	0.000901	-0.1799	0.001817	0.556267	-0.55627	0.000993	-0.19826

3.1.3 Arbitrary shape particle

• The final names of the subfolders include:

Wavelength (lmd), the real part of refractive index (n), the imaginary part of refractive index (k).

Example: lmd0.355_n1.3249_k0 means that the wavelength is 0.355, the real part of refractive index (n) is 1.3249, the imaginary part of refractive index (k) is 0.

• For arbitrary shape particle, the file names have the following format:

`[Name of file]_[Wavelength]_[Real part of refractive index ]_[Imaginary part of refractive index].`

Example: "Arbitrary1_output_lmd0.355_n1.3249_k0" means that the file name “`Arbitrary1_output`”, the wavelength is 0.355, the real part of refractive index (n) is 1.3249, the imaginary part of refractive index (k) is 0.

• Data files have the following structure:

`[Dmax] [V] [CS] [LR] [LDR] [CDR] [M11] [M14] [M22] [M33] [M41] [M44] [m14] [m22] [m33] [m41] [m44]`

Example:

Dmax	V	CS	LR	LDR	CDR	M11	M14	M22	M33	M41	M44	m14	m22	m33	m41	m44
5	21.03716	10.45088	54.45685	0.554068	2.138927	0.383823	0.000344	0.110136	-0.11014	0.001094	0.139266	0.000895	0.286945	-0.28695	0.002849	0.36284

• Similarly for particles 2, 3, 4

3.1.4 Droxtals

• The final names of the subfolders include:

Wavelength (lmd), the real part of refractive index (n), the imaginary part of refractive index (k).

Example: lmd0.355_n1.3249_k0 means that the wavelength is 0.355, the real part of refractive index (n) is 1.3249, the imaginary part of refractive index (k) is 0.

• For droxtal, the file names have the following format:

`[Name of file]_[Wavelength]_[Real part of refractive index ]_[Imaginary part of refractive index].`

Example: "Droxtal_output_lmd0.355_n1.3249_k0" means that the file name "`Droxtal_output`", the wavelength is 0.355, the real part of refractive index (n) is 1.3249, the imaginary part of refractive index (k) is 0.

• Data files have the following structure:

`[Dmax] [V] [CS] [LR] [LDR] [CDR] [M11] [M14] [M22] [M33] [M41] [M44] [m14] [m22] [m33] [m41] [m44]`

Example:

Dmax	V	CS	LR	LDR	CDR	M11	M14	M22	M33	M41	M44	m14	m22	m33	m41	m44
10	378.7192	67.32383	49.79739	0.403925	1.242378	2.70391	0.001027	1.148019	-1.14802	0.004879	0.292265	0.00038	0.424577	-0.42458	0.001804	0.10809

3.1.5 Bullet

• The final names of the subfolders include:

Wavelength (lmd), the real part of refractive index (n), the imaginary part of refractive index (k).

Example: lmd0.355_n1.3249_k0 means that the wavelength is 0.355, the real part of refractive index (n) is 1.3249, the imaginary part of refractive index (k) is 0.

• For bullet, the file names have the following format:

`[Name of file]_[Wavelength]_[Real part of refractive index ]_[Imaginary part of refractive index]_[Calculation range in microns].`

Example: "Bullet_output_lmd0.355_n1.3249_k0 (range 10-100 microns)" means that the file name "`Bullet_output`", the wavelength is 0.355, the real part of refractive index (n) is 1.3249, the imaginary part of refractive index (k) is 0, the calculation ranges 10 to 100 microns.

• Data files have the following structure:

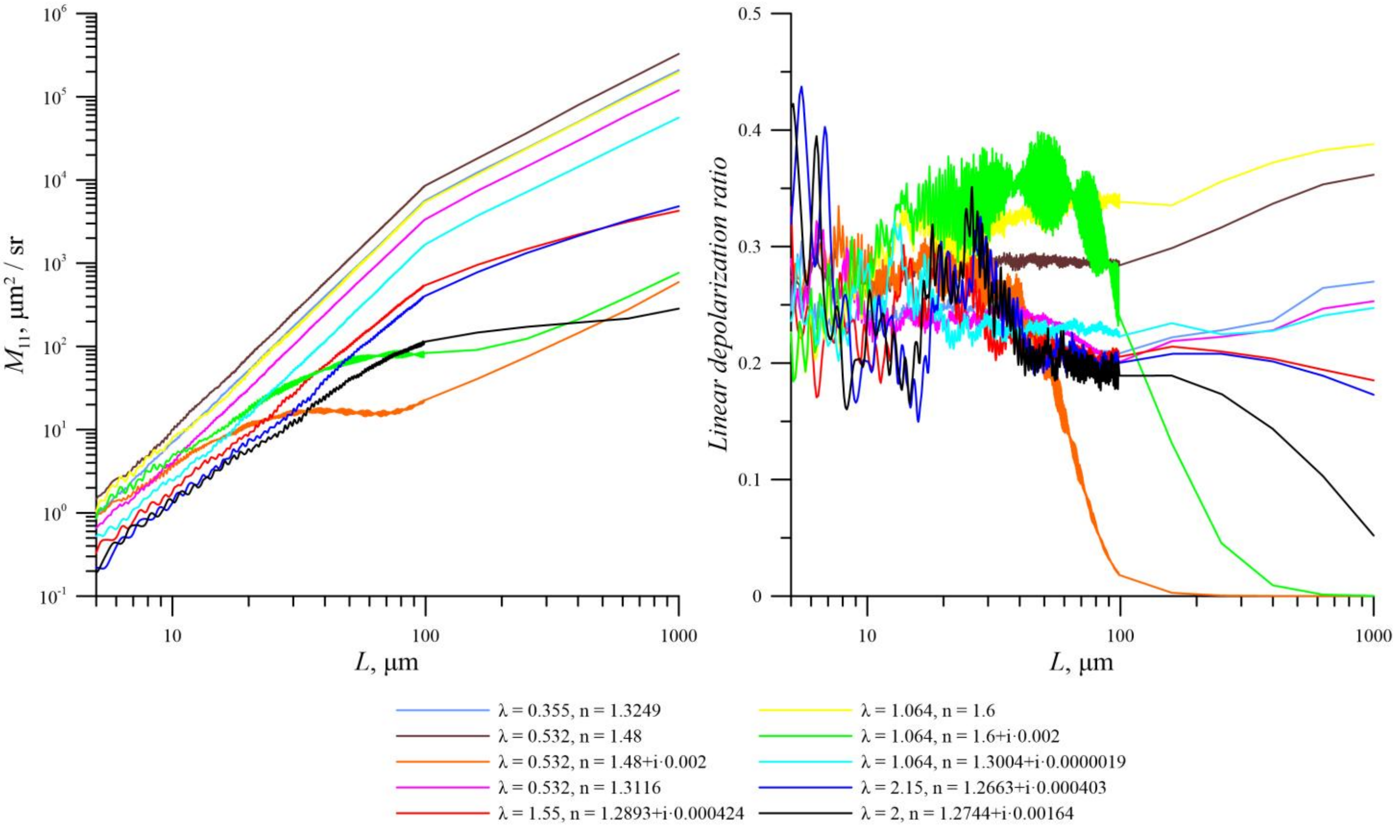
`[Column width D] [Column height L] [h] [Dmax] [V] [CS] [LR] [LDR] [CDR] [M11] [M14] [M22] [M33] [M41] [M44] [m14] [m22] [m33] [m41] [m44]`

Example:

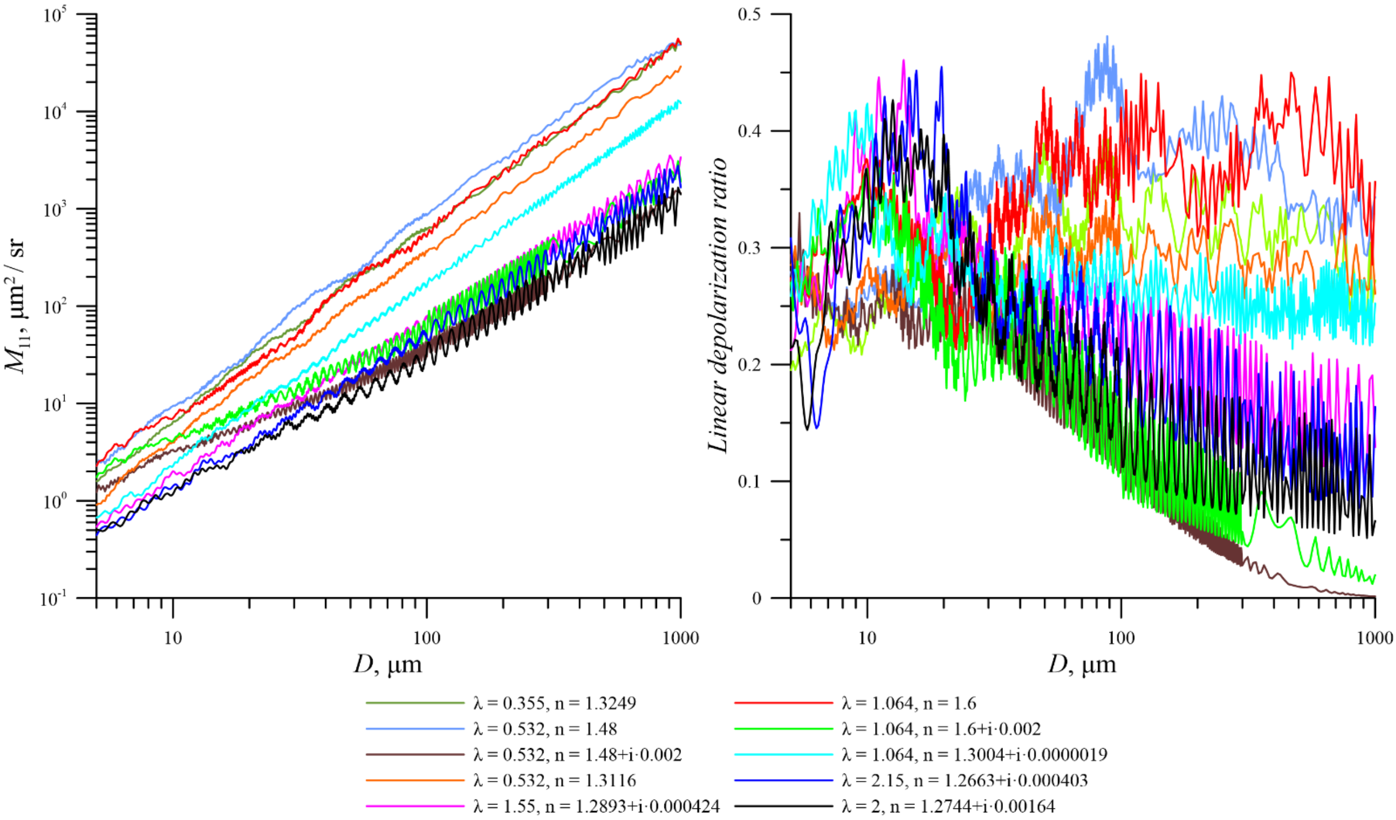
D	L	h	Dmax	V	CS	LR	LDR	CDR	M11	M14	M22	M33	M41	M44	m14	m22	m33	m41	m44
7	10	5.700649	16.08603	378.7414	77.40462	39.59339	0.292215	0.562836	3.45579	-0.00639	1.89284	-1.89284	-0.00847	-0.96667	-0.00185	0.54773	-0.54773	-0.00245	-0.27972

For column particles and bullet, the range from 100 to 1000 with nodal points (160, 250,400, 630 and 1000 microns) was calculated. This was necessary to speed up the calculations. The final result is located in a folder called "averaged". The result for the nodal point was taken from averaging the range around the nodal point. The size range around the nodal point is also represented in folders named "Range 160 microns", "Range 250 microns", etc.

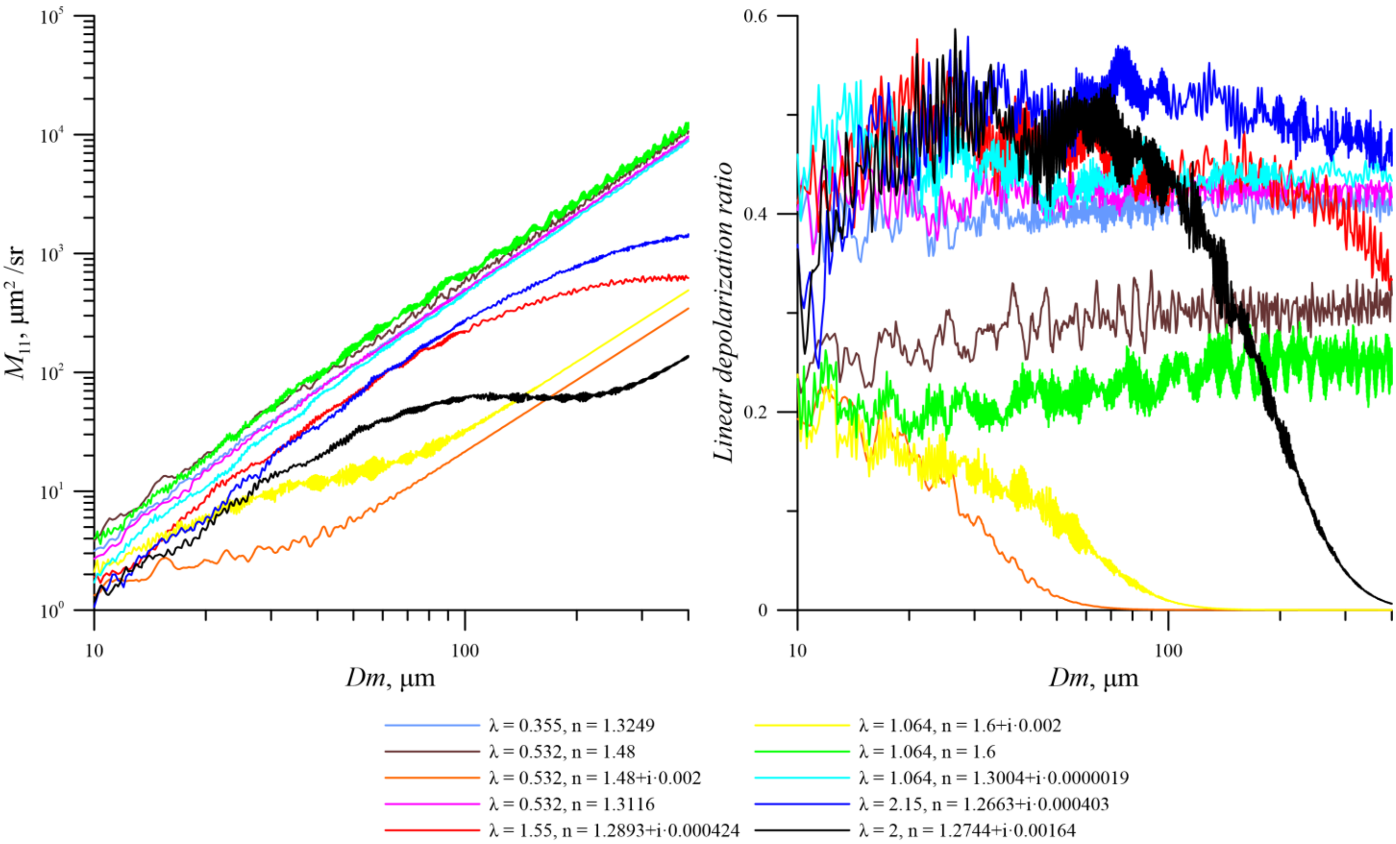
4. Illustration of the database



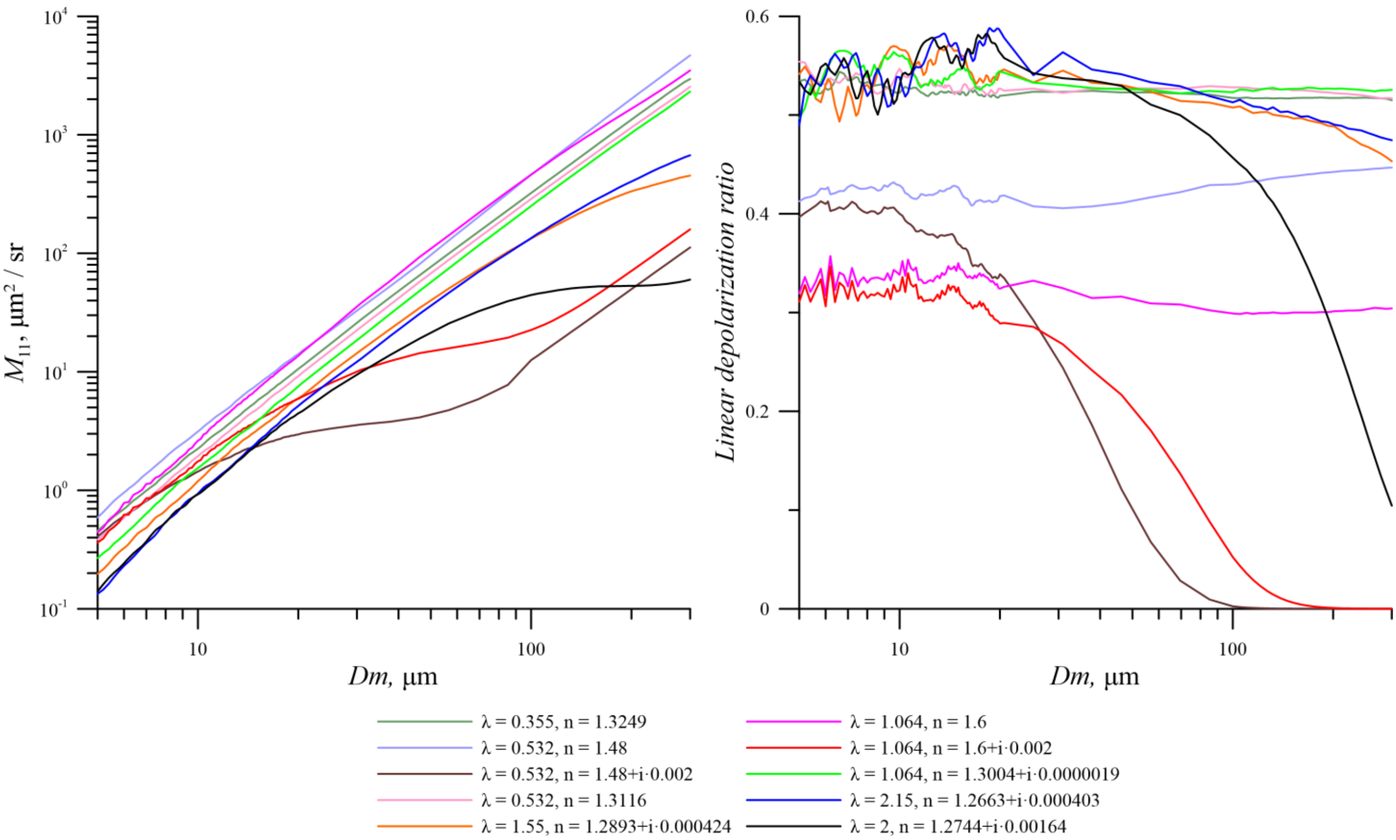
The dependence of the M_{11} element of the backscattering matrix and the linear depolarization ratio (*LDR*) on the length of the hexagonal column



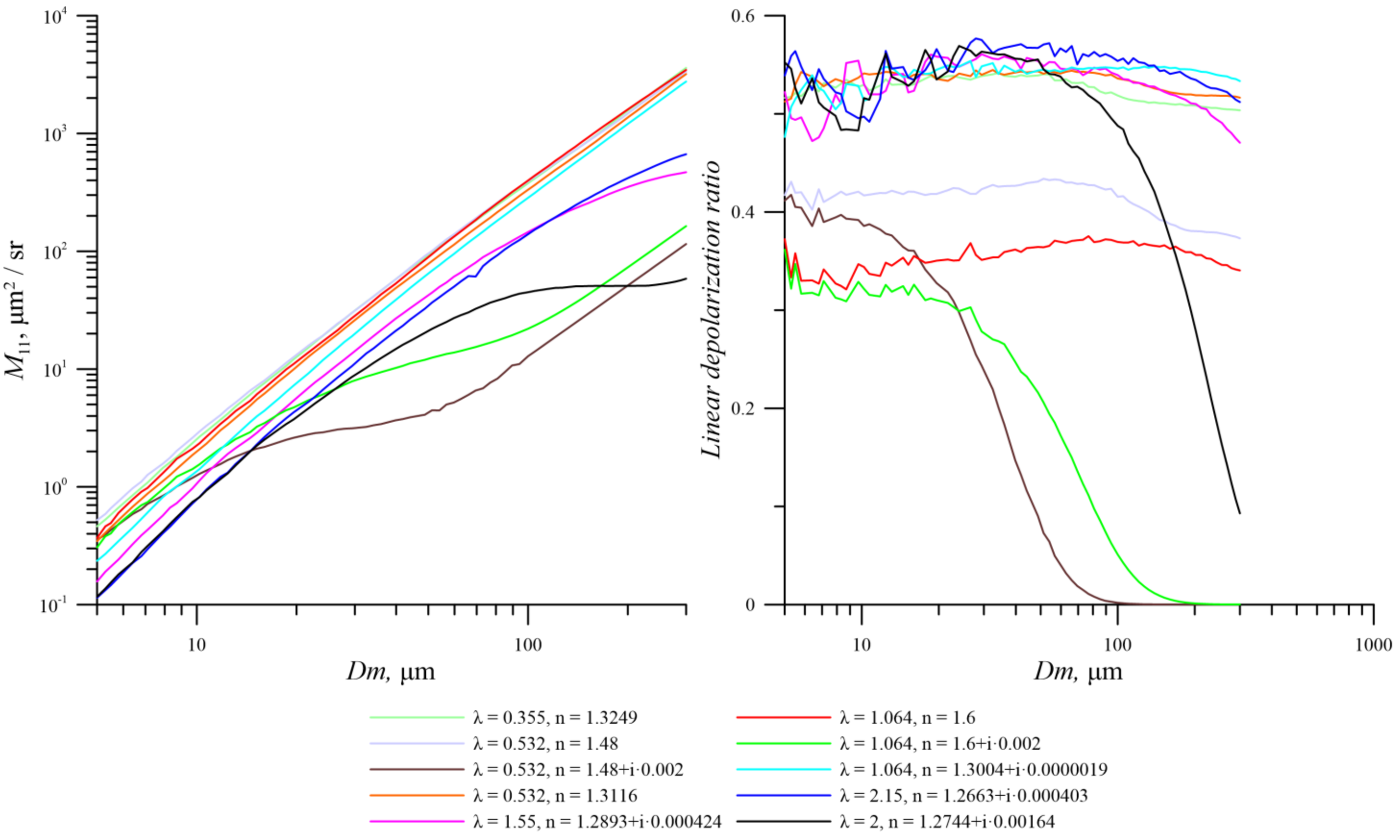
The dependence of the M_{11} element of the backscattering matrix and the linear depolarization ratio (*LDR*) on the width of the hexagonal plate



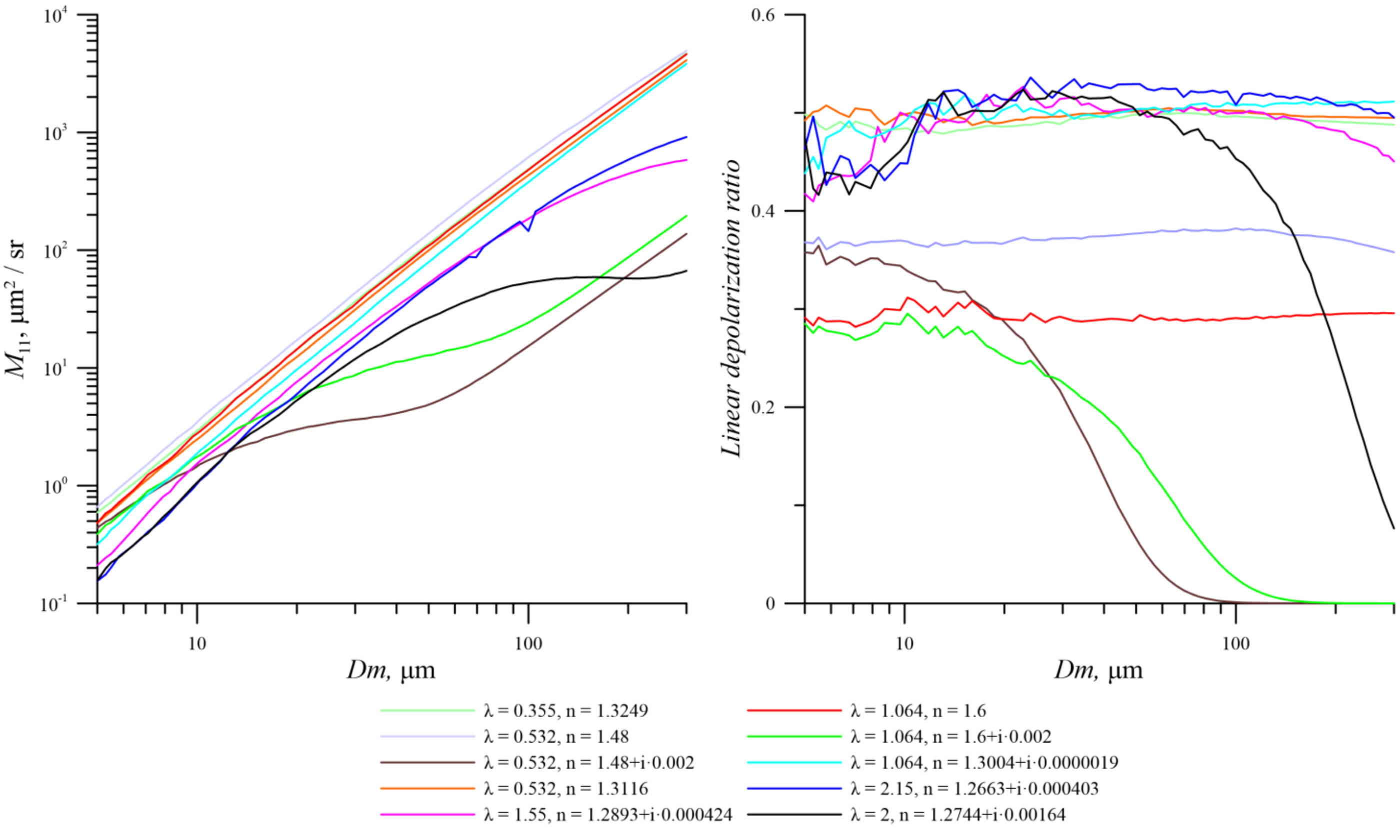
Dependence of the M_{11} element of the backscattering matrix and the linear depolarization ratio (*LDR*) on the Dmax of the droxtal



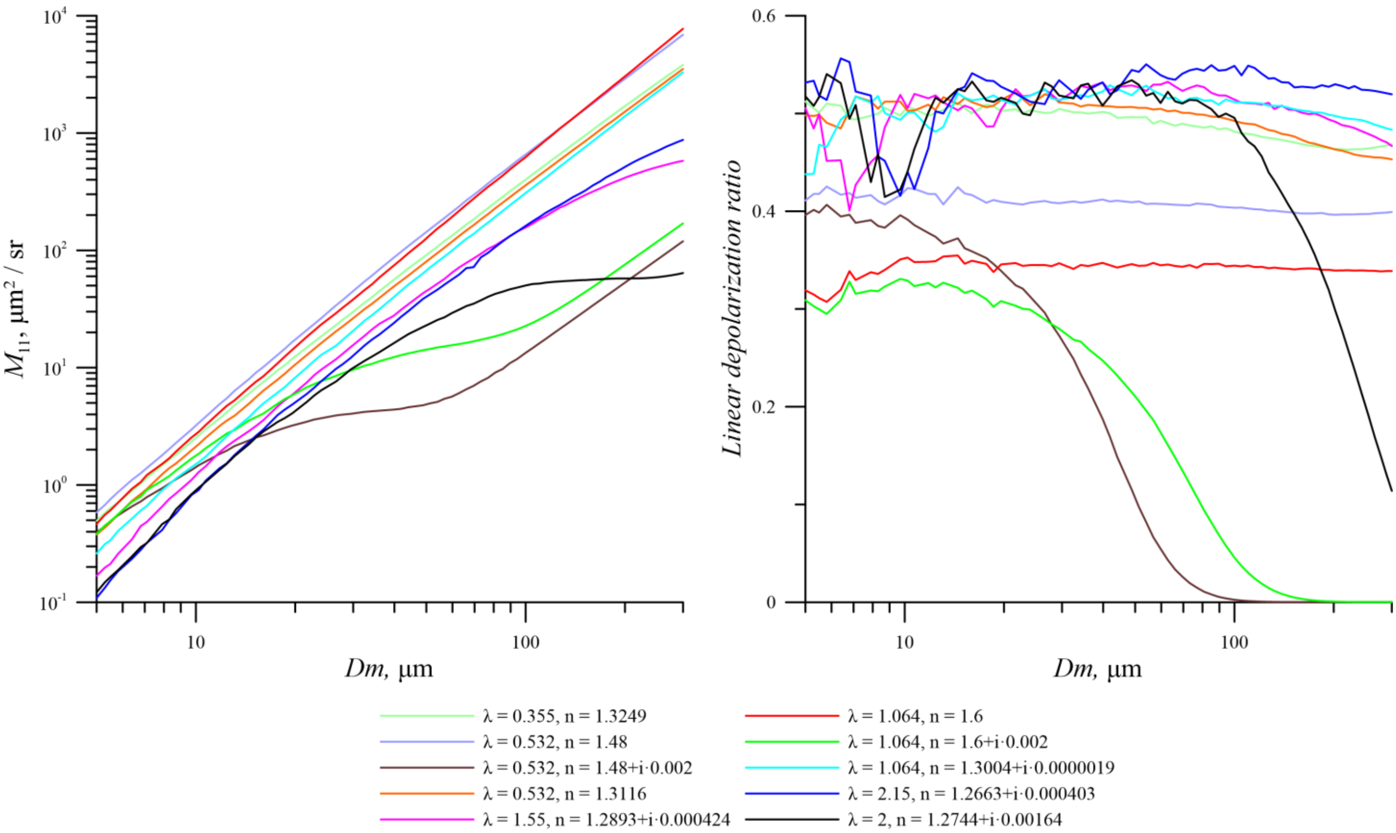
Dependence of the M_{11} element of the backscattering matrix and the linear depolarization ratio (*LDR*) on the Dmax of an arbitrary shape particle № 1



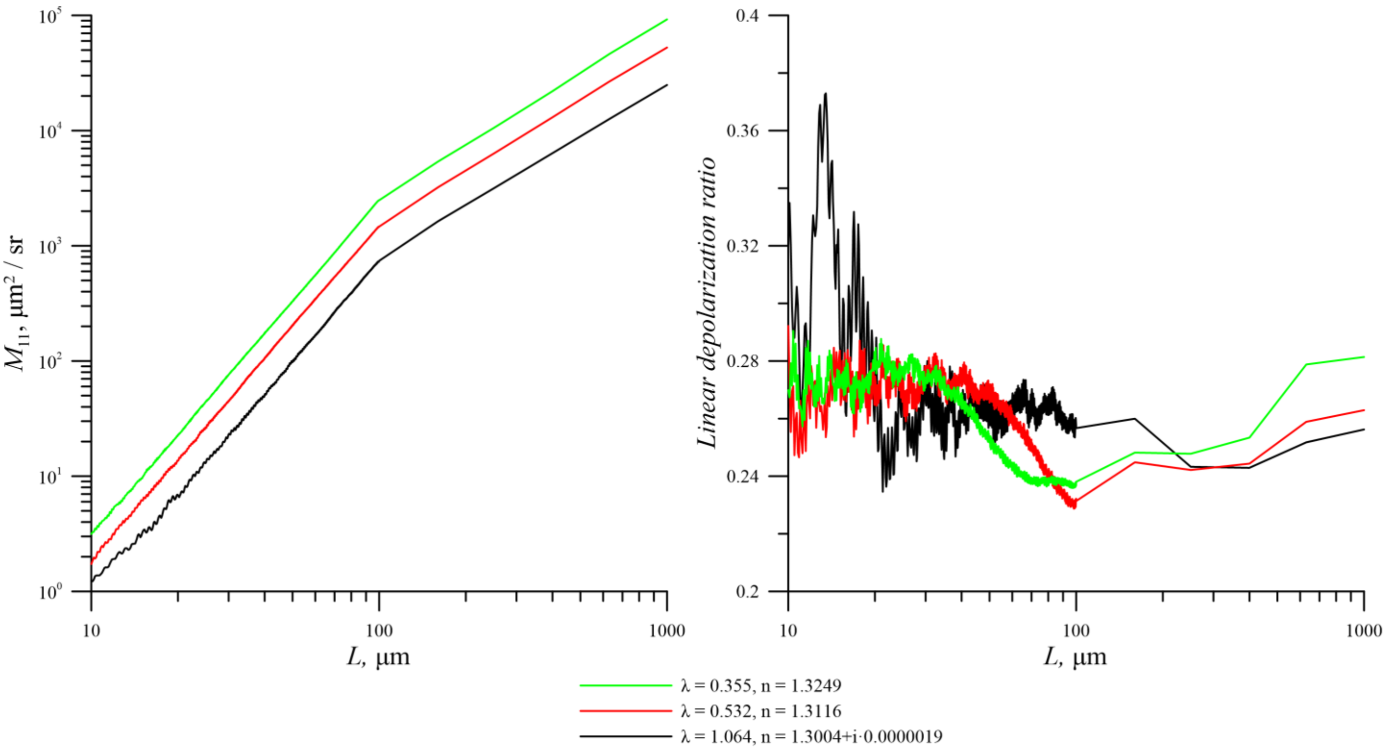
Dependence of the M_{11} element of the backscattering matrix and the linear depolarization ratio (*LDR*) on the Dmax of an arbitrary shape particle № 2



Dependence of the M_{11} element of the backscattering matrix and the linear depolarization ratio (*LDR*) on the Dmax of an arbitrary shape particle № 3



Dependence of the M_{11} element of the backscattering matrix and the linear depolarization ratio (*LDR*) on the Dmax of an arbitrary shape particle № 4



The dependence of the M_{11} element of the backscattering matrix and the linear depolarization ratio (*LDR*) on the length of the bullet