Anisotropic quantum scattering in plane

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We study the quantum scattering in two spatial dimensions (2D) [1]. Our computational scheme allows to quantitatively analyze the scattering parameters for the strong anisotropy of the interaction potential. High efficiency of the method is demonstrated for the 2D scattering on the cylindrical potential with the elliptical base and dipole-dipole collisions in the plane. We reproduce the result for the 2D scattering of polarized dipoles in binary collisions obtained recently by Ticknor [2] and explore the 2D collisions of unpolarized dipoles (see Figure 1). In Figure 2 the total cross section σ presented as a function of the angles α and β. The cross section was calculated for the case $Dq = 10$, where $D = md^2/(2\hbar^2)$ is the dipolar length and $q = \sqrt{2mE}/\hbar$ is the relative momentum. We found progressive narrowing of the resonance area with a simultaneous decrease of the amplitudes of the resonance oscillations with increasing angle β from 0 to π due to the dominance of the repulsive feature of dipole-dipole potential for $\beta \to \pi$.

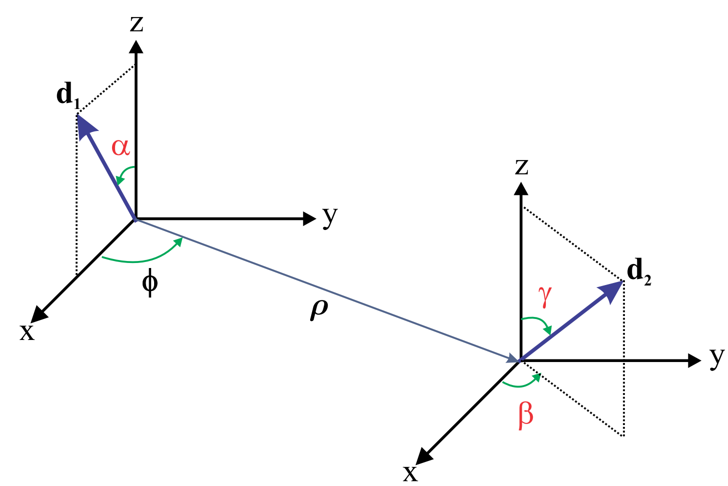

Figure 1: *Collision in the plane XY of two arbitrarily oriented dipoles d_1 and d_2*

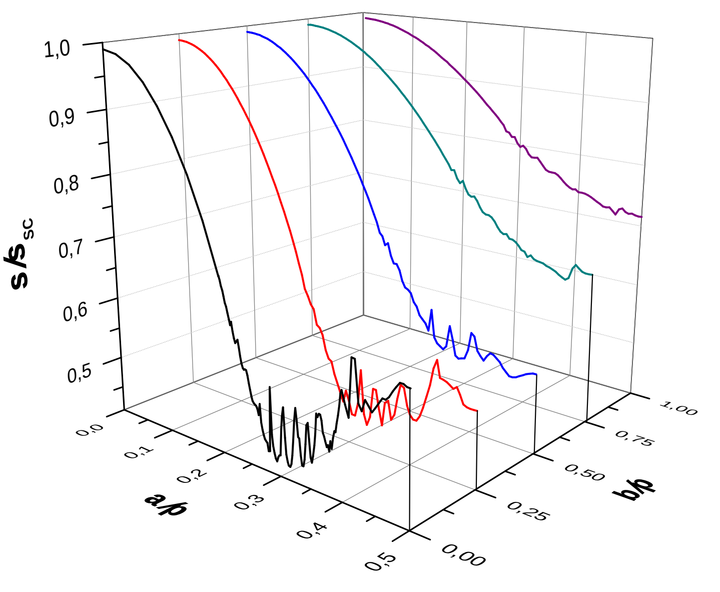

Figure 2: *The total cross sections σ as a function of the dipole tilt angle $\alpha = \gamma$ and the rotational angle β (cross sections are given in the units of $\sigma_{SC} = \frac{4}{q}\sqrt{\pi D q}$)*

References

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