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Dependences of the differential cross sections of 2D bosonic and fermionic dipoles scattering on the angles of the dipoles' mutual orientation

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In recent years, two-dimensional (2D) systems of polar diatomic molecules with anisotropic interaction have attracted increased interest. Studies of the interactions of dipole diatomic molecules are also relevant due to their possible applications as qubits for quantum computing schemes.

We revealed the strong dependence of the angular distributions of the 2D dipolar scattering differential cross section $d\sigma/d\Omega$ on the angles of the dipoles' mutual orientation.
The differential cross section angular distributions for bosons exhibit circular shape in the resonant ρ_{SR} points both for $\alpha = 45^{\circ}$ and $\alpha = 90^{\circ}$, indicating $s-$wave dominance in the resonance emergence. At dipole tilt angles, which are larger than a critical angle, the $d\sigma/d\Omega$ angular distribution has disturbed resonant-like form at the points of total cross section minimum. Whereas at the tilt angle $\alpha = 90^{\circ}$ angular distributions of $d\sigma/d\Omega$ are strongly anisotropic at the points of a minimum of total cross section, indicating that the $s-$wave contribution is suppressed and the scattering is governed by higher partial waves. So, in contrast to the central potentials, the 2D low-energy dipolar scattering of bosons is strongly anisotropic and its properties are highly sensitive to the dipoles mutual orientation.
The angular distributions of differential cross section $d\sigma/d\Omega$ of the dipolar scattering of fermions are always anisotropic.The angular distributions of the 2D dipolar scattering differ significantly from the angular distributions of differential cross sections of the 3D dipolar scattering [J. L. Bohn et.al., PRA 89, 022702 (2014)]. Dipolar fermions can scatter more strongly than dipolar bosons in the 3D case [Bohn PRA 89, 022702 (2014)], whereas in a 2D case the cross section of dipolar scattering of fermions is several orders of magnitude less than the scattering cross section of bosons at low energies.
The results are published [E. A. Koval et.al. Physical Review A. 102, no. 4. 042815 (2020)].

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