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Anisotropy induced Feshbach resonances in quantum dipolar gas of magnetic atoms[1] ALEXANDER PETROV, Temple University, EITE TIESINGA, NIST/JQI, SVETLANA KOTOCHIGOVA, Temple University — The best atoms to search for effects of anisotropy on collisions are submerged-shell atoms, which have an electronic configuration with an unfilled inner shell shielded by a closed outer shell. In particular, we are interested in the $^5I_8$ ground-state rare-earth dysprosium (Dy) atom with total atomic angular momentum $j = 8$ and a large magnetic moment of $\approx 10\mu_B$, for which the $4f^{14}$ electrons in the inner shell are aligned in such a way that the orbital moment is largely unquenched. As a result, Dy magnetic and electrostatic properties are highly anisotropic. Here we introduce a new coupled-channel model allowing us to calculate the anisotropy-induced magnetically-tunable Feshbach resonance spectrum of bosonic Dy atoms. The model treats the Zeeman interaction of the Dy atoms due to an external magnetic field and the magnetic dipole-dipole, (isotropic and anisotropic) electrostatic dispersion, and electric quadrupole-quadrupole interactions on equal footing. Our detailed quantum mechanical calculation describes a novel anisotropic nature of Feshbach resonances in interactions between magnetic Dy atoms and reveals a striking correlation between anisotropy in magnetic and electrostatic interactions and the Feshbach spectrum.

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