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The Interparticle Interaction Between a Vertically Aligned Dust Particle Pair in a Complex Plasma.¹ KE QIAO, ZHIYUE DING, JIE KONG, LORIN MATTHEWS, TRUELL HYDE, CASPER, Baylor University — The interaction between dust particles is a fundamental topic in complex plasma. In experiments on earth, the interparticle interaction in the horizontal direction (i.e., perpendicular to the gravitational force) is generally recognized to be a Yukawa potential. However, the interaction in the vertical direction is much more complicated, primarily due to the ion flow in the plasma sheath. In this research, we introduce a non-intrusive method to study the interaction between a vertically aligned dust particle pair confined in a glass box placed on the lower powered electrode within a GEC reference cell. This system is investigated for varying rf powers to obtain the trend of the interparticle interaction strength, which is contrasted with theoretical results. Using spontaneous thermal fluctuations of the neutral gas as the only driving force, we obtain the normal mode spectra of the dust pair, revealing not only the oscillation frequencies, but also the vibration amplitudes of the normal modes. The interaction strength between the upper and lower particle is obtained quantitatively from these mode spectra, showing strong nonreciprocity in both the vertical and horizontal directions. It will also be shown that the resulting horizontal attractive force of the upper particle on the lower particle can be larger than the horizontal confinement produced by the glass box alone.

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