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Long-range attraction of an ultrarelativistic electron beam by a column of neutral plasma

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We report on the experimental observation of the attraction of a beam of ultrarelativistic electrons towards a column of neutral plasma. In experiments performed at the FACET test facility at SLAC we observe that an electron beam moving parallel to a neutral plasma column, at an initial distance of many plasma column radii, is attracted into the column. Once the beam enters the plasma it drives a plasma wake similar to that of an electron beam entering the plasma column head-on. A simple analytical model is developed in order to capture the essential physics of the attractive force. The attraction is further studied by 3D particle-in-cell numerical simulations.

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