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Stability Conditions for Trapping of Low Index Contrast Particles Dual Beam Optical Trap ALISON HUFF, CHARLES MELTON, LINDA HIRST, JAY SHARPING, Univ of California - Merced — The use of radiation pressure to hold and manipulate microscopic dielectric particles is driving fundamental advancements in our understanding of the machinery that makes up living cells. The dual-beam fiber-optical trapping configuration is particularly useful due to its diverging beams, allowing larger particles to be trapped with little photodamage. Most such studies are conducted using particles in a medium where the refractive index contrast between the particle and surrounding medium is relatively large: $m = (n_{particle}/n_{medium}) > 1.1$. However, the low-$m$ case is of practical interest because it often applies to cells in vivo and artificially-synthesized vesicles where the internal and external media are similar to one another. We find experimentally and theoretically that there are regimes of fiber separation, particle size and refractive index contrast where the magnitudes of the gradient forces are nearly the same as the scattering forces, leading to multiple stable trapping locations. Besides being important for understanding the unusual behavior such a system may display, it raises the possibility of using a single-fiber trap for manipulating lipid vesicles.

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