Abstract Submitted
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Experiments with BECs in a Painted Potential: Atom SQUID, Matter Wave Bessel Beams, and Matter Wave Circuits[1] MALCOLM BOSHIER, CHANGHYUN RYU, PAUL BLACKBURN, ALINA BLINOVA, KEVIN HENDERSON, Los Alamos National Laboratory — The painted potential is a time-averaged optical dipole potential which is able to create arbitrary and dynamic two dimensional potentials for Bose Einstein condensates (BECs). This poster reports three recent experiments using this technique. First, we have realized the dc atom SQUID geometry of a BEC in a toroidal trap with two Josephson junctions. We observe Josephson effects, measure the critical current of the junctions, and find dynamic behavior that is in good agreement with the simple Josephson equations for a tunnel junction with the ideal sinusoidal current-phase relation expected for the parameters of the experiment. Second, we have used free expansion of a rotating toroidal BEC to create matter wave Bessel beams, which are of interest because perfect Bessel beams (plane waves with amplitude profiles described by Bessel functions) propagate without diffraction. Third, we have realized the basic circuit elements necessary to create complex matter wave circuits. We launch BECs at arbitrary velocity along straight waveguides, propagate them around curved waveguides and stadium-shaped waveguide traps, and split them coherently at y-junctions that can also act as switches.

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