Minicolloque n° MCPG10 **(Oral Presentation)**

What happens when a rotating observer detects an analogue Unruh particle?

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With the recent success using an analogue black hole system to observe Hawking radiation [1], there is a growing interest in using analogue systems to probe other experimentally inaccessible phenomena. In particular, can an analogue system exhibit the Unruh effect, the notoriously inaccessible flat-spacetime counterpart of Hawking radiation? A recent proposal [2,3] indicates that it should be possible to observe an analogue of the circular Unruh effect, by moving the interaction point between a laser and a two-dimensional Bose-Einstein condensate (BEC) along a circular trajectory. Just as a linearly-accelerating detector registers Rindler particles in the Minkowski vacuum [4], the laser phase registers "particles" along the circular interaction trajectory; these "particles" are associated with phonon modes in the BEC that are positive-frequency with respect to the analogue proper time along the trajectory. I will discuss new results that shed light on longstanding issues with interpreting the circular Unruh effect, and revisit the surprisingly contentious tautology "a particle is what a particle-detector detects."

[1] J.R. Muñoz de Nova et al., Nature **569**, 688 (2019)
[2] C. Gooding et al., Phys. Rev. Lett. **125**, 213603 (2020)
[3] S. Biermann et al., Phys. Rev. D **102**, 085006 (2020)
[4] W.G. Unruh and R.M. Wald, Phys. Rev. D **29**, 1047 (1984)

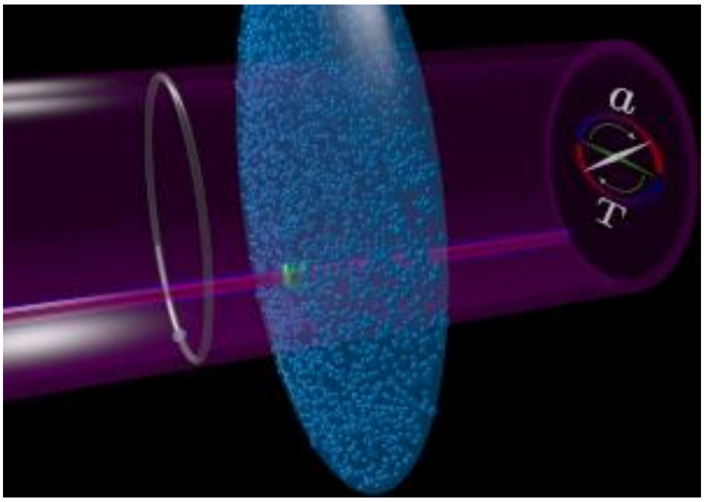

Figure 1 : Proposed setup for observing the analogue circular Unruh effect. By moving the point of interaction between a laser and a two-dimensional Bose-Einstein condensate (BEC) along a circular trajectory, the laser field serves as an analogue detector, responding to local density fluctuations from the BEC along the path. The density fluctuations behave as an analogue relativistic vacuum field with an effective speed of light given by the speed of sound in the BEC.