



Contribution ID: 123

Type: **Invited talk in the parallel session**

Quantum detection of inertial frame dragging

Monday, 5 July 2021 18:37 (18 minutes)

The Unruh De-Witt detector was introduced originally to give an operational meaning to particle detection in curved spacetimes. This simple two level quantum system interacts with the quantum field through a monopole type coupling, possibly exciting it to the excited state in the process. As the vacuum state of the field depends on global features of the background spacetime, the transition probability of a detector may be able to pick up these features too. As a result, UDW are better-than-classical-detectors. Due to inertial frame dragging, inertial observers inside of a spherical rotating shell are dragged into rotation with respect to distant stars. However to a classical observer inside the shell, the local surrounding spacetime is Minkowski – by performing local gravitational experiments, the observer cannot tell if the shell is rotating. In contrast, we shall see that the transition probability of a UDW detector is sensitive to the shell’s rotation. This is true even when the “switched-on” time of the detector is shorter than the time it takes for a signal to travel to the shell and back.

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Session Classification: Dragging is Never Draggy: MAss and CHarge Flows in GR

Track Classification: Precision Tests: Dragging is never draggy: MAss and CHarge flows in GR