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Status of Birkhoff's theorem in polymerized semiclassical regime of Loop Quantum Gravity

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The collapse of a spherically symmetric ball of dust has been intensively studied in Loop Quantum Gravity (LQG). From a quantum theory, it is possible to recover a semiclassical regime through a polymerization procedure. In this setting, general solutions to the Polymerized Einstein Field Equations (PEFE) will be discussed both for the interior and the exterior of the dust cloud. Exterior solutions are particularly interesting since they may lead to a semiclassical version of the Birkhoff's theorem. It is seen that if time independence of the vacuum is imposed, there exists a class of solutions depending on two parameters. Nevertheless, the possibility of more intricate time dependent solutions is not ruled out completely.

A second approach to study semiclassical spacetimes is by considering an Oppenheimer-Snyder model. Namely, one glues the portion of spacetime containing dust with the vacuum part by matching the extrinsic curvatures. In this way, one gets a metric tensor for the vacuum which can be compared to the one obtained previously. Although these two methods are completely independent from each other, the results we obtained are in perfect agreement.

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