

Admissible Symmetries of the Electromagnetic Field in LRS Spacetimes

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Locally Rotationally Symmetric (LRS) spacetimes have long been of interest as cosmological and other models. Seminal early work [1] considered perfect fluid and perfect fluid with electromagnetic field solutions. Recent work [2] continues to study electromagnetic phenomena related to LRS spacetimes.

We re-examine the classical question of locally rotationally symmetric spacetimes with perfect fluid and electromagnetic field. While it had been previously thought that in these spacetimes the electric and magnetic field vectors must both lie along the space-like local axis of symmetry, S , we show that an additional case is admissible: The stress-energy tensor of the electromagnetic field can also have the desired symmetry if both the electric and magnetic fields are orthogonal to S . The physical interpretation in this case is that the Poynting vector, representing the energy flux of the electromagnetic field, lies along S . We examine this case and show how it specializes LRS type II solutions.

[1] J.M. Stewart, G.F.R. Ellis, Einstein's equations for a fluid which exhibits local rotational symmetry, *J. Math. Phys.* 9 (1968), 1072-1082.

[2] Burston et al, 1+1+2 electromagnetic perturbations on general LRS spacetimes: Regge-Wheeler and Bardeen-Press equations. *Quantum Grav.* 25 (2008) 75003.