

Classifying Time Independent Plane Symmetric Spacetime through Noether's Approach

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Abstract : The universe is expanding at an accelerated rate. Symmetries are useful in understanding universe's behavior. Emmy Noether reported the relation between symmetries and conservation laws. These symmetries are known as Noether symmetries which correspond to a conserved quantity. In differential equations, conservation laws play an important role. Noether symmetries are helpful in modified theories of gravity. Time independent plane symmetric spacetime was classified by Noether's theorem. By using Noether's theorem, set of linear partial differential equations was obtained having $A(r)$, $B(r)$ and $F(r)$ as unknown radial functions. The Lagrangian corresponding to considered spacetime in the Noether equation was used to get Noether operators. Different possibilities of radial functions were considered. Firstly, all functions were same. All the functions were considered as non-zero constant, linear, reciprocal and exponential respectively. Secondly, two functions were proportional to each other keeping third function different. Second case has four subcases in which four different relationships between $A(r)$, $B(r)$ and $F(r)$ were discussed. In all cases, we obtained nontrivial Noether operators including gauge term. Conserved quantities for each Noether operators were also presented.

Keywords : Noether gauge symmetries, radial function, Noether operator, conserved quantities

Conference Title : ICMPS 2017 : International Conference on Mathematics and Physical Sciences

Conference Location : Istanbul, Türkiye

Conference Dates : October 26-27, 2017