

Re: Noether charge & generators of symmetry

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ygor.geurts@xxxxxxxxx wrote:

I have the following question. I'm wondering if anyone could explain to me the mathematics behind the (physics) statement that the noether charge of an infinitesimal symmetry is the generator of the symmetry?

This statement is relation between dynamic in tangent bundle and cotangent bundle (phase space). Same Lie group act on tangent bundle and we want to induce this action on phase space. This is difficult task in general, but we can take explicitly constructed conserved charge $Q(q, \dot{q}, t)$ and rewrite it in terms of phase space: $Q(q, p, t)$. Now using Poisson bracket we have actions of our Lie algebra on phase space via $\{Q_i, *\}$. Of course by construction $\{Q_i, H\} = 0$. Key question: is it true that the $\{Q_i, Q_j\}$ obey Lie algebra relations? In general is not (so called classical anomaly)! But in concrete cases we can check relations by hands. In many physical problem $\{Q_i, Q_j\}$ give Lie algebra of the symmetry group.

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