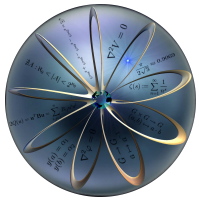

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## Lie groupoid

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|---|---|
| Canonical name | LieGroupoid |
| Date of creation | 2013-03-22 19:19:21 |
| Last modified on | 2013-03-22 19:19:21 |
| Owner | bci1 (20947) |
| Last modified by | bci1 (20947) |
| Numerical id | 15 |
| Author | bci1 (20947) |
| Entry type | Definition |
| Classification | msc 22E70 |
| Classification | msc 22E60 |
| Classification | msc 20F40 |
| Classification | msc 22A22 |
| Classification | msc 20L05 |
| Related topic | Groupoid |
| Related topic | GroupoidRepresentation4 |
| Related topic | RepresentationsOfLocallyCompactGroupoids |
| Related topic | Functor |

**Definition 0.1.** A *Lie groupoid* is is a category $\mathcal{G}_L = (G_0, G_1)$ in which every arrow or morphism is invertible, and also such that the following conditions are satisfied:

1. The space of objects $G_0$ and the space of arrows $G_1$ are both smooth manifolds
2. Both structure maps $s, t : G_1 \longrightarrow G_0$ are smooth
3. All structure maps are submersions:

$$s, t : G_1 \longrightarrow G_0,$$

$$u : G_0 \longrightarrow G_1,$$

$$i : G_1 \longrightarrow G_1,$$

and

$$m : G_1 \times_{s,t} G_1 \longrightarrow G_1$$

.

**Notes:** A Lie groupoid can be considered as a generalization of a Lie group, but it does have the additional requirements for the groupoid's structure maps that do not have corresponding conditions in the simpler case of the Lie group structure. Because the object space $G_0$ of a Lie groupoid $\mathcal{G}_L$ is a smooth manifold, $G_0$ is denoted in this case as $M$.