## Institut für Geometrie und Topologie

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## Octonions, Triality, Oct-Octonions and the Lie Brackets of the Exceptional Lie algebras F<sub>4</sub> and E<sub>8</sub>

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Abstract: The exceptional Lie groups and Lie algebras  $G_2$ ,  $F_4$ ,  $E_6$ ,  $E_7$ ,  $E_8$  were first described by Wilhelm Killing in 1888. Since then, they have made many appearances in geometry, topology, and physics. However, they still remain somewhat elusive and mysterious. To this day, for instance, no explicit formula for the Lie bracket appears to be known. In this talk, I will explain how to obtain an explicit formula for the bracket of  $F_4$ , using octonions and the triality description of  $F_4$ . It turns out that this formula can be further generalized to an explicit formula for the bracket of the exceptional simple Lie algebra  $E_8$ , based on the so-called Barton-Sudbery description. This involves replacing octonions with oct-octonions and so(8) with so(8)+so(8).



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