

# SFB 767 Seminar

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## Nonmagnetic spin filter based on single molecular junction

The field of spintronics is based on spin-polarized currents in which the current is dominated by one electronic spin type. For example, key spintronic phenomena, as magnetoresistance and spin transfer torque could not be activated without such currents. Spin polarized currents are practically produced by spin injection from magnetic materials or by separating spin currents with the aid of magnetic fields. Here, we show that spin-polarized currents can be generated at the single-molecule scale without magnetic components or magnetic fields. Specifically, shot noise measurements detect spin polarized currents in single molecule junctions based on silver electrodes bridged by a vanadocene molecule with total spin  $S=3/2$ . In contrast, the electronic transport through similar junctions based on ferrocene with  $S=0$  do not show any indication for spin polarized currents. Transport calculations compared with conductance and shot noise measurements reveal a mechanism based on spin-dependent quantum interference at the  $S=3/2$  single molecule junction that can lead to high current spin filtering. Our measurements indicate that the conductance of some junction configurations is dominated by a single spin-polarized transmission channel with conductance near the upper limit of spin-polarized quantum transport,  $e^2/h$  ( $e$  is the electron charge, and  $h$  is the Planck's constant). These findings pave the way for spintronic manipulations by quantum interference at the molecular scale.

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1. *Nonmagnetic single-molecule spin-filter based on quantum interference*, Atindra Nath Pal et. al. (under review)
2. *Electronic conduction during the formation stages of a single-molecule junction*, Atindra Nath Pal, Tal Klein, Ayelet Vilan, and Oren Tal, *Beilstein J. Nanotechnol.* 9, 1471–1477 (2018)