Pseudoresistor-based transimpedance amplifiers for high-speed, highresolution sensing of Rydberg excited gases | 5YR	Start Date: Mai 1st 2017
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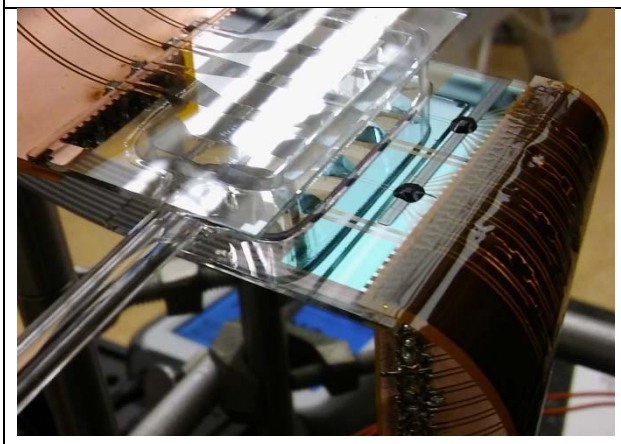

Abstract: The use of hot Rydberg excited gases flowing through electrically contacted glass cells offers the possibility of assembling gas sensors which are sensitive in the ppb regime. Currently, a first demonstrator for the detection of smallest amounts of Rb in an N2 gas flow is being built in a cooperation between the 5th Institute of Physics (5th PI) and the Institute of Large Area Microelectronics (IGM) at USTUTT. Preliminary results indicate that the achievable resolution and operation speed of the sensor is limited by the quality of the necessary transimpedance amplifier (TIA) in the readout circuit. This amplifier needs to have a high gain and a low offset and also needs to provide a low input referred noise and a very low input capacitance to maximize the achievable bandwidth. Here, to minimize the additional stray capacitance introduced by interconnects at the TIA's input, the amplifier must be placed as close as possible to the Rydberg excitation zone inside the glass cell. Naturally, this location places stringent requirements on amplifier robustness due to the harsh environment created by the species under test. To meet all of these requirements, in the proposed project, two approaches will be investigated in a cooperation between the 5th PI and the IGM at USTUTT and the Institute of Microelectronics (UULM). The first months of the project have been used to develop a Rydberg gas cell that is compatible (electrically, mechanically and chemically) to Ulm's monolithic TIA which has successfully been operated for the first time recently. Implementation of the TIA in IGM's low temperature poly silicon manufacturing process is currently in progress.

Recent results: *Successful operation of gas cells using Ulm's TIA for signal amplification*	**Publications:** D. Djekic, G. Fantner, J. Behrends, K. Lips, M. Ortmanns and J. Anders, "A transimpedance amplifier using a widely tunable PVT-independent pseudo-resistor for high-performance current sensing applications," ESSCIRC 2017 - 43rd IEEE European Solid State Circuits Conference, Leuven, 2017, pp. 79-82.

Further Collaborators: