

GSI/Aachen/JGU-Mainz

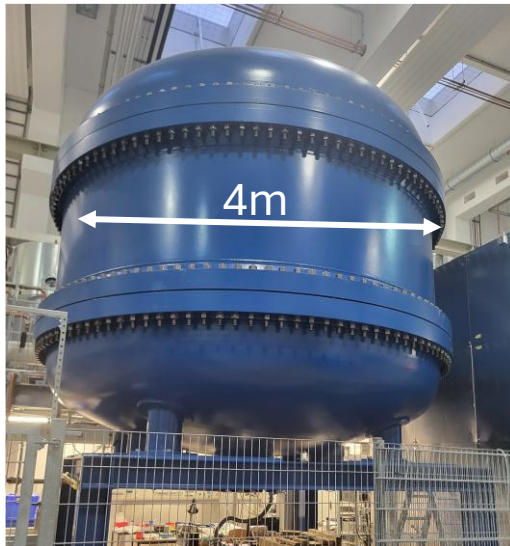
Studying systematic effects
in storage rings for EDM measurements

Using existing infrastructure & competence at Aachen/JGU Mainz/HIM/GSI to continue EDM-searches at world class level

- Searches for systematic effects on storing spin polarized charged **electrons**, aiming to control EDM limits smaller than any one achieved for free elementary particles so far
- We will investigate the effectivity of using:
 - 1.) the existing HESR cooler prototype at HIM (tank and high voltage platform) and
 - 2.) Copies of the existing MESA polarized source and spin-manipulators
- Study the potential of the possible set up, as sketched in the following transparencies. (1 Post Doc Aachen/1PhD JGU)

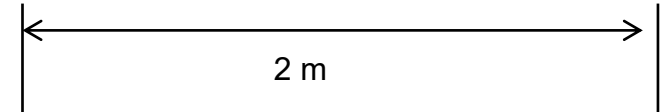
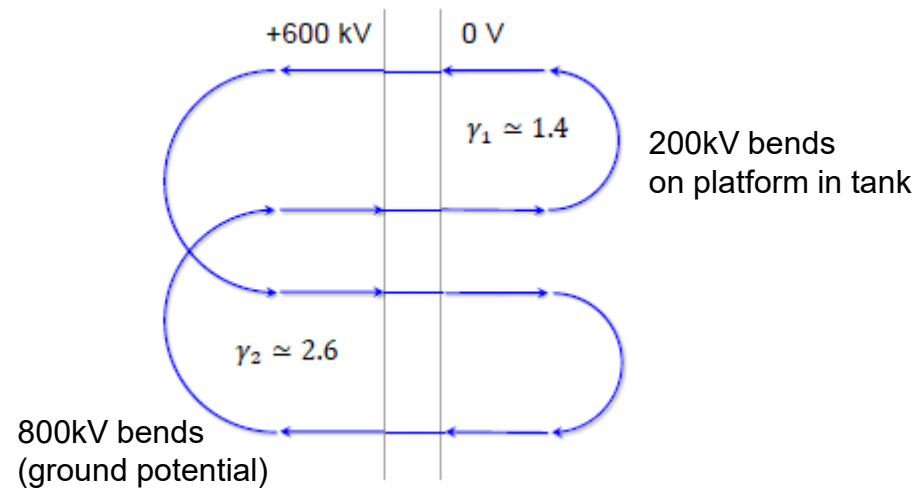
Existing hardware

The prototype HESR Cooler as versatile platform → All electric EDM-ring
Combine the cooler prototype at HIM with devices similar to those developed from MESA



Unique features of HESR cooler prototype:

- kW el. power available at 600kV
- on **large** HV-platform
- Ample space above platform... due to pressure tank design for 2 platforms

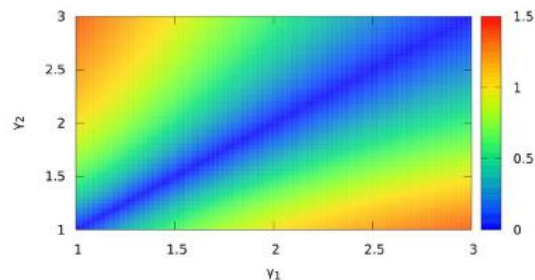


3d-spin rotator at MESA

Operating mode of electrostatic
Figure of 8 EDM Ring proposed
by Derbenev, Suleiman et. al.
arXiv:2105.11575v1 [physics.acc-ph], 24 May 2021):

Figure of 8 Ring with only Electrostatic Bends and two Energies.

The Figure of 8 periodic system cancels the magnetic g-2 precession after each turn.
Electrostatic figure of 8 rings can be operated clockwise and counter-clockwise
The electric fields acting on the EDM during acceleration cause an EDM-dependent spin precession, to be measured with a Mott polarimeter

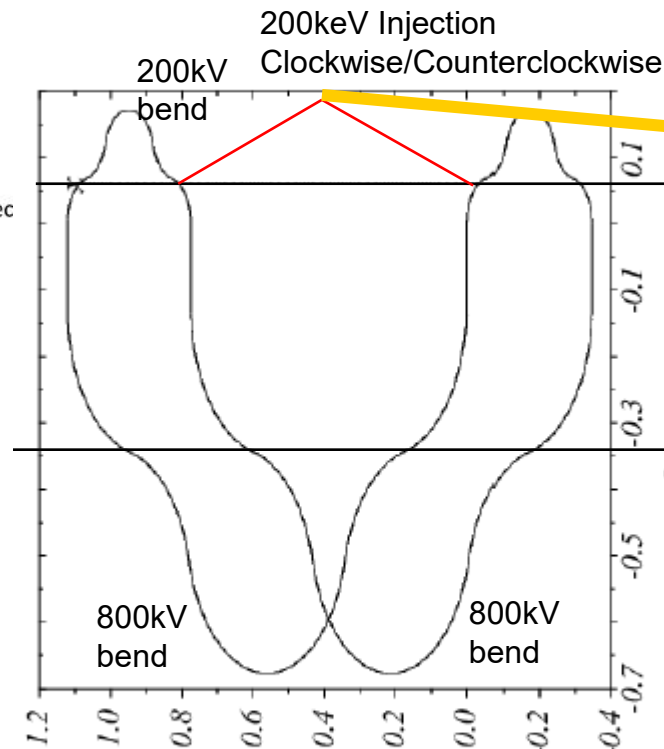


$$\frac{\partial^2 |\psi_{EDM}^{ST}|}{\partial \eta \partial t} \times 10^9 \text{ rad/sec}$$

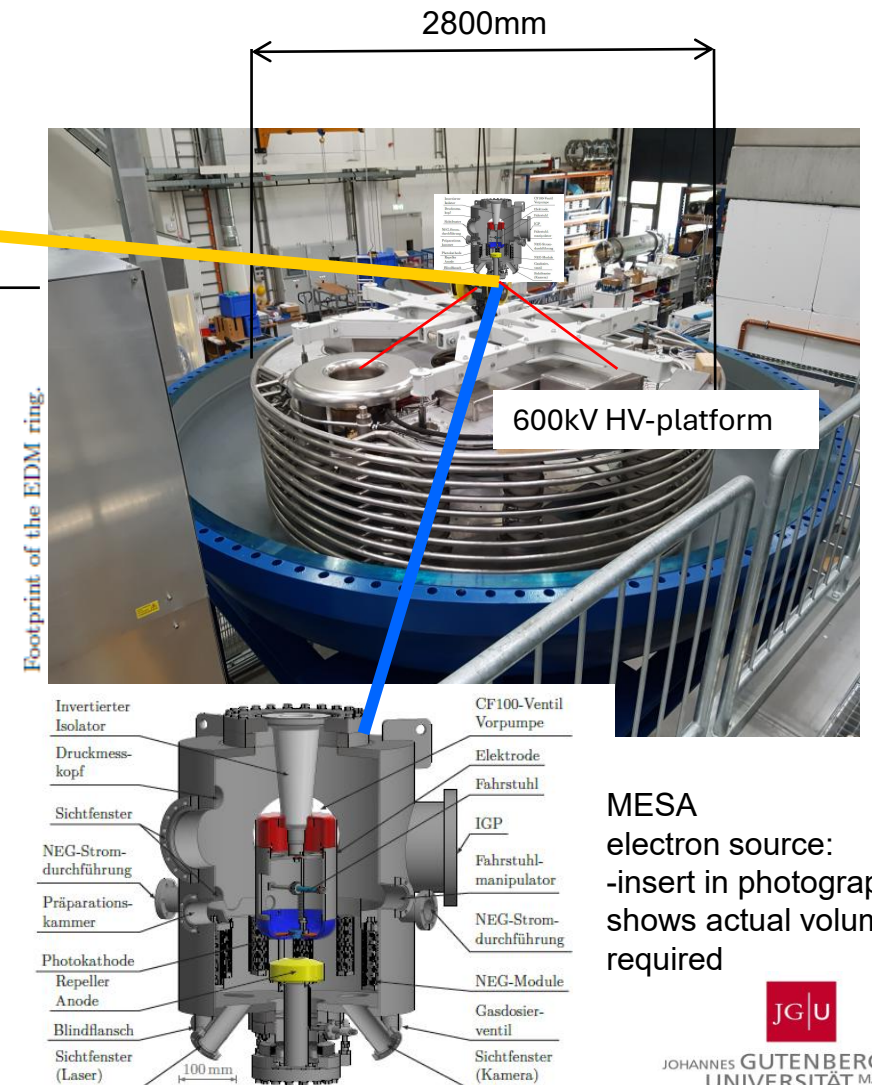
R. Suleiman, V. Morozov, Y. Derbenev
arXiv:2105.11575v1 [physics.acc-ph] 24 May 2021

EDM Sensitivity of the order $<10^{-28} \text{ e}^* \text{cm}$ within
a few days measurement time anticipated!

→ But systematics?



Orbit layout of „Figure of 8“ Electrostatic storage ring (units are meters):
Fits into/onto HESR cooler prototype tank and platform
(200kV bends on platform, 800kV devices on ground potential)



MESA
electron source:
-insert in photograph
shows actual volume
required