



## Einladung zum Vortrag

# Metabolism Imaging via Quantum Entanglement & Entanglement Detection

von

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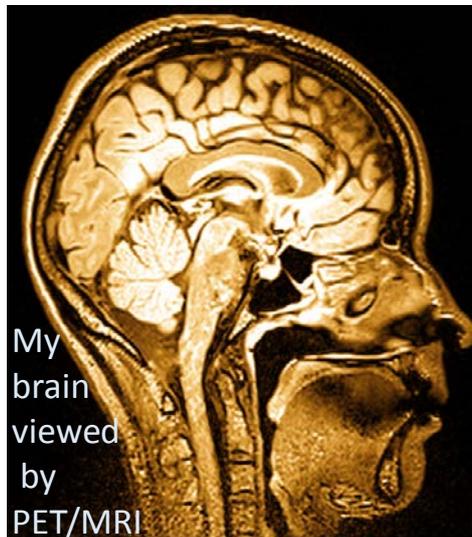
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**Termin:** Mittwoch, 14.03.2018, 10:15 Uhr

**Ort:** Josef-Stefan-Hörsaal  
9. Boltzmannngasse 5 / Strudlhofgasse 4, 3. Stock

### Abstract:

The detection of the two high energetic photons coming from the annihilation of an electron and a positron is a well-established successful technology to image metabolic processes in living bodies (PET: Positron Emission Tomography). positronium atoms are into three photons. Due to events have never been technology, the J-PET device computations [2] show that and, surprisingly, even entangled, which is a very Even more surprising, under entanglement survives. entanglement may open a example, in the above picture, gain quantum information on the microscopic scale. Let studies have shown a para- and ortho-positronium human tissues. Furthermore, progress in entanglement detection, e.g. based on mutually unbiased bases (MUBs) or symmetric informationally complete (SIC) operators, including some experiments that exploited those [3]. Last but not least, we present some of our recent results how quantum information theoretic considerations may solve some of the long awaited problems of Neutrino Physics, such as the mass hierarchy problem or whether neutrinos are Dirac or Majorana particles [4].



During such a typical scan formed which can as well decay technical limitations such registered, however, a new [1], will change that. Theoretical the three photons are entangled genuinely multipartite strong type of entanglement. mixing genuinely multipartite Observing the manifestations of plethora of possibilities: for for any pixel one would also which may equip us with details us also mention that our recent difference in the lifetimes of for cancerous and healthy we present our theoretical

[1] e.g.: D. Kamińska, et al., Eur. Phys. J. C 76, 445 (2016)

[2] B.C. Hiesmayr and P. Moskal, Scientific Reports 7, 15349 (2017).

[3] e.g.: B.C. Hiesmayr, M.J.A. de Dood and W. Löffler, Phys. Rev. Lett. 116, 073601 (2016); G. Carvacho, F. Graffitti, V. D'Ambrosio, B. C. Hiesmayr and F. Sciarrino, Scientific Reports 7, 13265 (2017).

[4] A. Capolupo, S. M. Giampaolo, B. C. Hiesmayr and V. Vitiello, accepted Physics Letters B (2018).