Offer for a PhD studentship in collaboration between academia and industry (CIFRE)
Simultaneous MRI-PET (project "LILI – Lyon Integrated Life Imaging: hybrid MRI-PET")
October 2013 for 3 years.

Context: Truly hybrid MRI-PET imaging will enable the acquisition of functional information by PET, and structural as well as functional information by MRI. The two modalities are complementary: PET offers unparalleled sensitivity to molecular events, while MRI offers high soft-tissue contrast and other information (diffusion, blood flow, tractography, spectroscopy). **Simultaneous acquisition is crucial for understanding many aspects of brain function.**

Environment: The "Lyon Integrated Life Imaging: hybrid MRI-PET" (LILI) project is organized around a core group of excellently evaluated research teams. They provide all the multidisciplinary skills needed for reliable and rapid development of MRI-PET imaging including MR physics, multimodal image analysis, radiotracer and contrast agent design, pharmacology, PET imaging and modelling, preclinical and clinical experimentation. The MRI-PET project has been financed through the French government's Equipments of Excellence initiative (LILI project), with major contributions through Lyon's newly created Brain and Mental Health institute (Institut CESAME), Lyon's university hospitals (HCL), and collaboration with the manufacturer (Siemens). Methodological developments specific to this new hybrid imaging modality have been identified and will be pursued in **close collaboration with Siemens in the framework of a strong partnership**. This studentship is co-financed by Siemens, and the successful candidate will join a growing team of MRI-PET methodologists at the CERMEP multimodal imaging centre. Work will be started on existing data from collaborators ahead of the machine's installation in early 2014.

Topic: How can MRI information be optimally used for attenuation correction? The design of integrated MRI-PET scanners precludes the usual approaches to attenuation correction, i.e. via rotating rod sources or CT. There are currently three main approaches to MR-based attenuation correction: Via tissue class segmentation and assigned attenuation factors based on the 2-point Dixon technique (1, 2); via ultra-short echo time (UTE) sequences where signal from bone and coils in the field of view can be obtained (3); and registration-based where existing MRI and CT data in register are transferred to a new dataset (4). For brain imaging, we will use our experience in multi-atlas registration and label propagation to develop a novel attenuation correction method expected to outperform existing approaches (5, 6). In addition, acquisition sequences based on multi-points in-and-out-of-phase techniques will be developed.

Supervision: A Hammers, Neurodis; N Costes, CERMEP; C Lartizien, O Beuf, CREATIS; Siemens engineer to be recruited

Profile: Candidates with a degree in mathematics, physics, biomedical engineering, computer science or similar are encouraged to apply. A background in either MRI or PET Imaging is desirable. Equal opportunities policies are respected. For more information and an informal discussion, interested candidates should contact:

Prof Alexander Hammers (alexander.hammers@fondation-neurodis.org; +33 4 72 68 86 34)
Dr Nicolas Costes (costes@cermep.fr; +33 4 72 68 86 04)

Applications, including CV and previous experience, should be sent to both A. Hammers and N. Costes.

References: 1. Hofmann M, Pichler B, Scholkopf B, Beyer T. Towards quantitative PET/MRI: a review of MR-based attenuation correction techniques. Eur J Nucl Med Mol Imaging. 2009 Mar;36 Suppl 1:S93-104. 2. Zaidi H, Montandon ML, Meikle S. Strategies for attenuation compensation in neurological PET studies. Neuroimage. 2007 Jan 15;34(2):518-41. 3. Tyler DJ, Robson MD, Henkelman RM, Young IR, Bydder GM. Magnetic resonance imaging with ultrashort TE (UTE) PULSE sequences: technical considerations. J Magn Reson Imaging. 2007 Feb;25(2):279-89. 4. Schreibmann E, Nye JA, Schuster DM, Martin DR, Votaw J, Fox T. MR-based attenuation correction for hybrid PET-MR brain imaging systems using deformable image registration. Med Phys. 2010 May;37(5):2101-9. 5. Heckemann RA, Hajnal JV, Aljabar P, Rueckert D, Hammers A. Multiclassifier fusion in human brain MR segmentation: modelling convergence. Med Image Comput Comput Assist Interv. 2006;9(Pt 2):815-22. 6. Heckemann RA, Keihaninejad S, Aljabar P, Rueckert D, Hajnal JV, Hammers A. Improving intersubject image registration using tissue-class information benefits robustness and accuracy of multi-atlas based anatomical segmentation. Neuroimage. 2010 Jan 28;51:221-