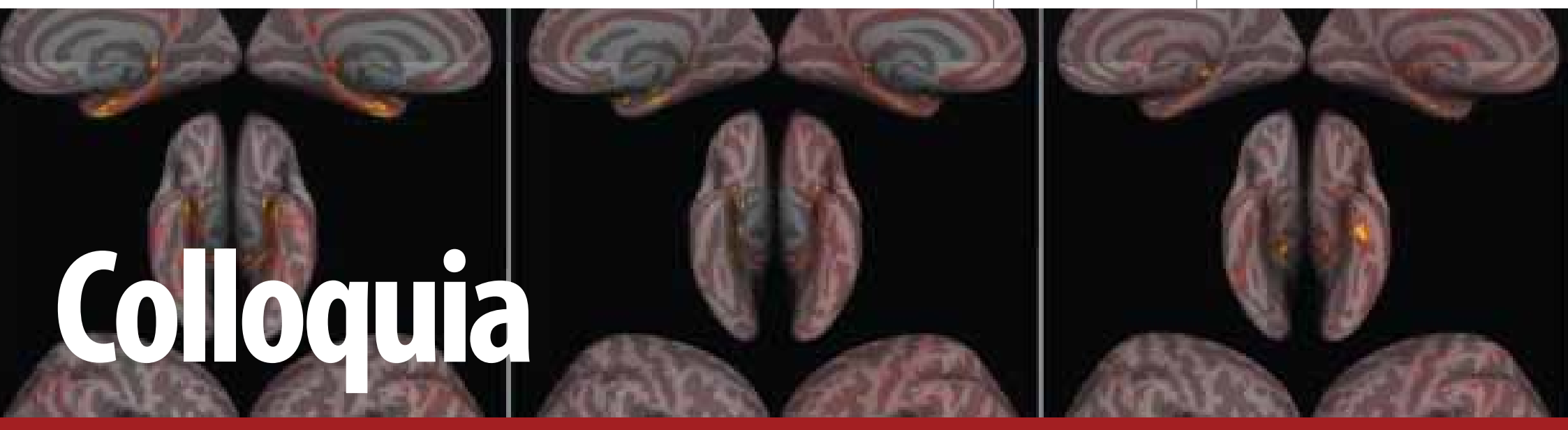
Department of Physics



Colloquia

FALL 2014

www.physics.bilkent.edu.tr

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Early Diagnosis of Alzheimer Disease Using Multimodal Imaging

day	location	time
DECEMBER 10, 2014 WEDNESDAY	EE01	15:40

ABSTRACT

Alzheimer Disease (AD) is a very complex and heterogeneous neurodegenerative disorder. The disease is characterized by neuronal dysfunction and death which is related to the amyloid-β peptide and hyperphosphorylation of the microtubule protein tau. These abnormal changes in the brain finally lead to a gradual loss of cognitive functions such as episodic memory. Since both the patient and his/her family are affected by the devastating consequences of the disease, there is a great need for new diagnostic tools for early detection with the hope that future medicines and early intervention will stop or significantly reduce disease progression and deterioration. Different biomarkers are currently being investigated and incorporated in the new diagnostic criteria for AD. These biomarkers describe the different pathological events that occur in the brain. The biomarkers can be measured in vivo using magnetic resonance imaging (MRI), positron emission tomography or in the cerebrospinal fluid (CSF). With advanced imaging techniques both structural and functional brain changes can be measured, such as atrophy, shrinkage caused by neuronal death (structural-MRI), changes in white matter integrity (diffusion tensor imaging) brain connectivity (functional-MRI) and the accumulation of the amyloid-β peptide in the brain (amyloid-PET). Due to the complexity of AD, one biomarker is probably not enough for early detection and diagnosis. Investigating patterns of disease combining different biomarkers, reflecting different aspects of the disease are likely to be more efficient. Large amounts of data are obtained from modern neuroimaging analysis tools. To fully take advantage, combine and interpret the complex biological data obtained requires the use of advanced statistical methods. Multivariate data analysis provides the opportunity to analyze many variables simultaneously and observe inherent patterns in the data. By doing so it is possible to separate groups, determine which factors cause the separation and make predictive models of disease. An effective combination of different biomarkers (patterns of disease) may prove to be more useful than using single biomarkers and could be a potent biomarker in itself for early diagnosis and to predict which subject will convert to AD in the future.

The Physics Colloquia are designed to address a non-specialist, broad audience and introduce topics of contemporary research through lectures by leading experts. We warmly invite all members of the student body, including undergraduates enrolled in any programme.

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