APEX sub-mm monitoring of gamma-ray blazars

S. Larsson, J. Larsson (Stockholm University),
L. Fuhrmann, A. Weiss, E. Angelakis, T.P. Krichbaum, I. Nestoras, J.A. Zensus (MPIfR, Bonn), on behalf of the F-GAMMA Collaboration
M. Axelsson, D. Nilsson, F. Ryde (KTH, Stockholm),
L. Hjalmarsdotter (Sternberg Observatory),
A. Lundgren, F. Mac-Auliffe, R. Parra, G. Siringo (ESO, Chile)

Abstract

A sample of about 40 gamma-ray blazars have been monitored at sub-mm wavelengths over a time period of 3 to 4 years. Observations were made with the LABOCA detector on the ESO/MPI/Swedish APEX telescope in Chile. Here, we present for the first time the full set of light curves that are used to study the sub-mm variability properties and how these relate to source types and gamma-ray characteristics as seen by Fermi LAT.

INTRODUCTION

Since 2008 we are running a blazar monitoring program using the APEX telescope. The aim of this project, which is part of the F-GAMMA program (e.g. Fuhrmann et al. 2007, Angelakis et al. 2008), is to make the first long-term systematic study of variability characteristics of gamma-ray blazars at sub-mm wavelengths. This includes variability amplitude, time scales and correlations with the variability at cm/mm, optical and gamma-ray bands.

APEX LABOCA

LABOCA (Siringo et al. 2008) is a 295 element bolometer array mounted on the APEX sub-mm telescope in Chile. The instrument has a total field of view of 11.4 arcmin and allow observations in the 870 micrometer (345 GHz) atmospheric window (bandwidth is 60 GHz).

OBSERVATIONS

Quasi-regular observations are performed during several dedicated MPI, Swedish and ESO APEX LABOCA time-blocks per year. In the future, we are aiming at a denser, more regular sampling through follow-up of the MPI/ Swedish/ESO time using also the regular and frequent pointing observations performed at APEX. The observations within the F-GAMMA project are typically performed in 'spiral observing mode' with a raster of 4 spirals each of 20 or 35 seconds of integration, depending on the source brightness at 345 GHz. At each run, Skydip measurements for opacity correction and frequent calibrator measurements are performed.

FIRST RESULTS: Sub-mm variability properties of gamma-ray AGNs

A first, preliminary variability analysis, without taking the time sampling into account, shows a relative variability as measured by the modulation index, m = 100 x rms/mean, which for most sources is in the range 20 - 70 %. A number of sources show variations by a factor of 10 or more between minimum and maximum flux. This is significantly larger than at the longer cm- and also short-mm bands. The variability is in general also faster and more directly correlated with the high energy emission. This is most likely an effect of opacity/synchrotron self-absorption increasing towards the longer radio wavelengths and indicates that the sub-mm emission regions are more co-spatial with the optical/gamma-ray ones.

Long-term APEX Light Curves

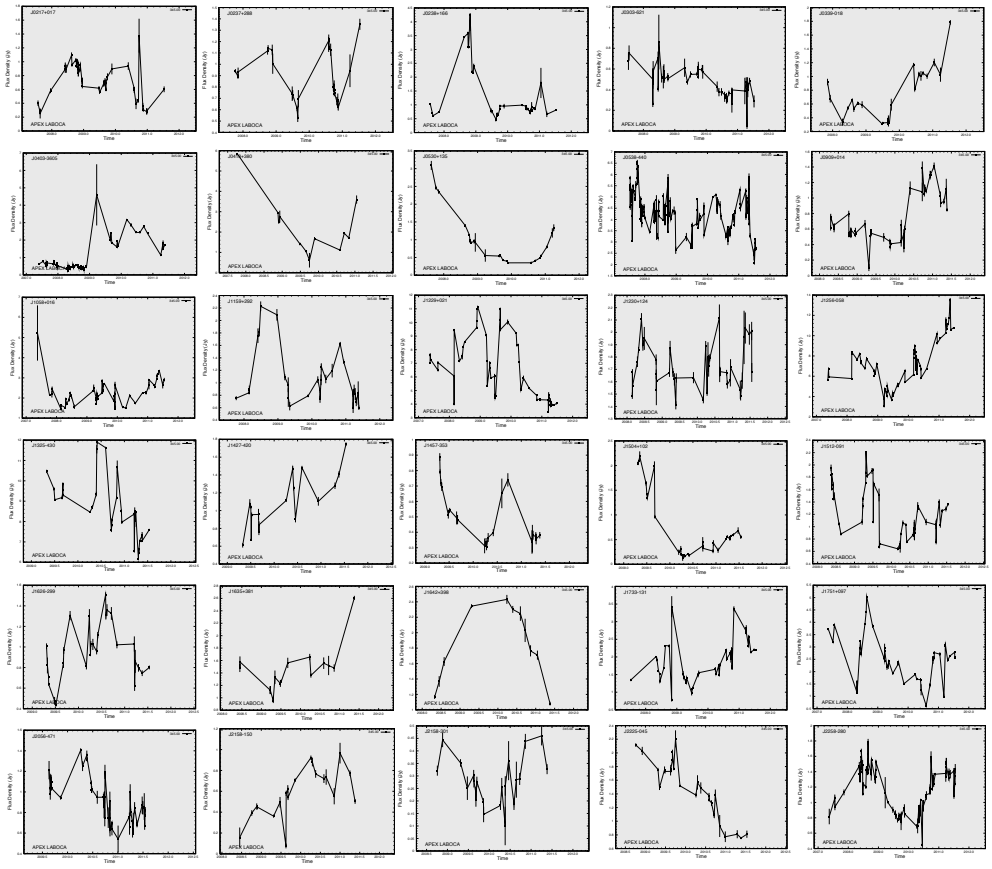

Figure 1. Long term light curves for a sample of blazars monitored at sub-mm wavelengths with the APEX telescope.

REFERENCES

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