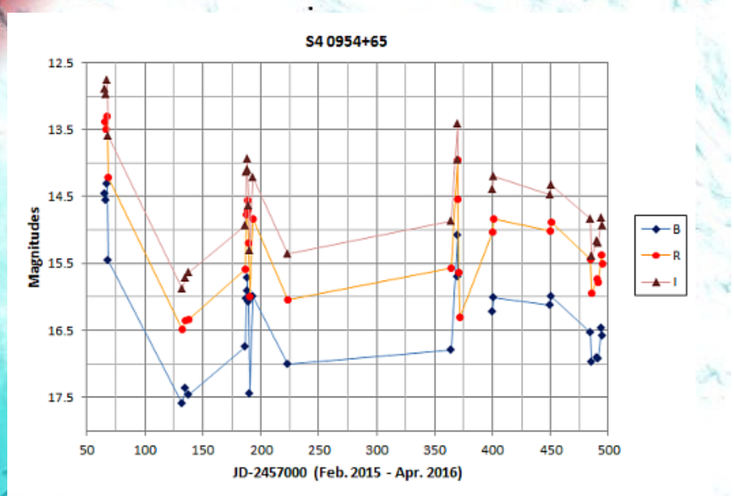
The extremes in intra-night blazar variability: the S4 0954+65 case

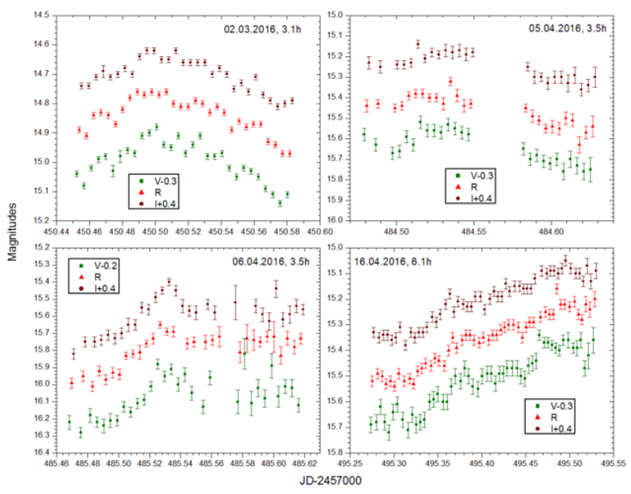
R. Bachev, A. Strigachev, E. Semkov, R. V. Munoz Dimitrova, G. Latev,
B. Spassov, B. Petrov
Institute of Astronomy, Sofia, Bulgaria

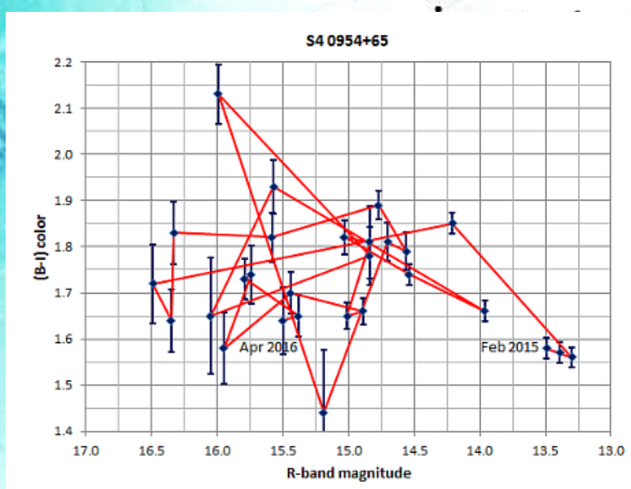
Abstract: We present results of optical observations of an extremely violently variable blazar S4 0954+65 on intra-night time scales. The object showed flux changes of up to 100% within a few hours. Time delays between optical bands, color changes and “rms-flux” relations are investigated and the results are discussed in terms of existing models of blazar variability.

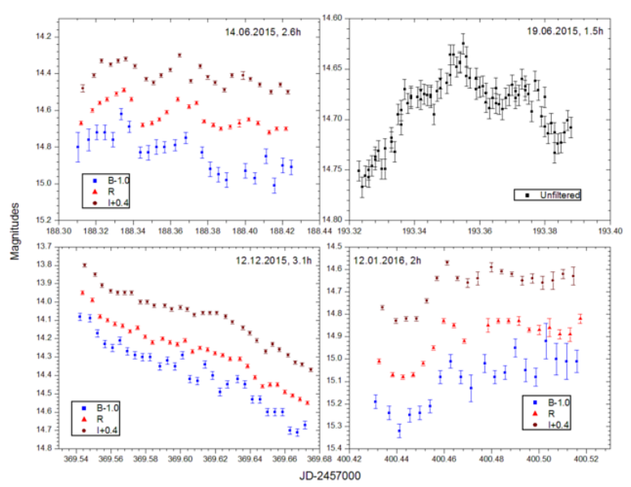
Observations: The blazar S4 0954+65 (z=0.368) was monitored on intra-night time scales with the 60cm telescope of Belogradchik observatory, Bulgaria for a total of ~64 hours between Feb. 2015 and Apr. 2016. The average monitoring duration for each run was about 3.5 hours. The object was observed semi-simultaneously in several wavebands (BVRI).

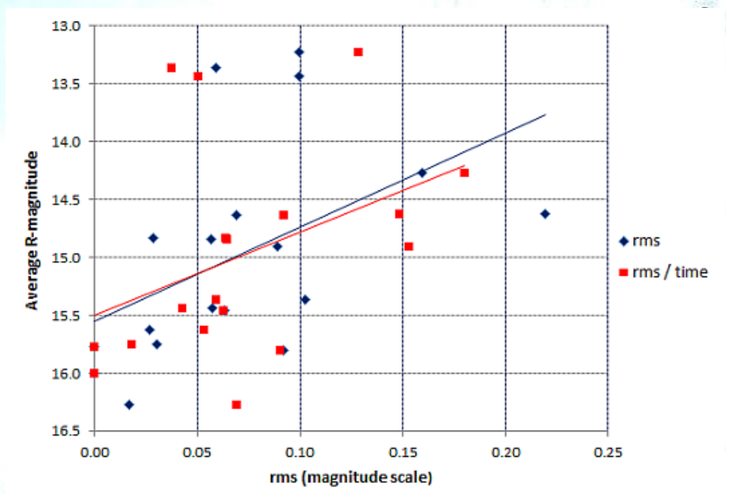
Results: S4 0954+65 showed during the time of monitoring exceptional intra-night variability, very rarely seen in other objects. At some occasions changes reached 0.5 – 0.7 magnitudes for several hours. Microvariations of up to 0.2 mag/hour were frequently observed. No reliable time lags between the bands were detected, considering the time resolution of the datasets, which is about 5 - 10 min (details in Bachev, 2015). Chromatic behavior was observed on longer time scales. The object clearly appears to be more active (in terms of fractional variability) during high states.

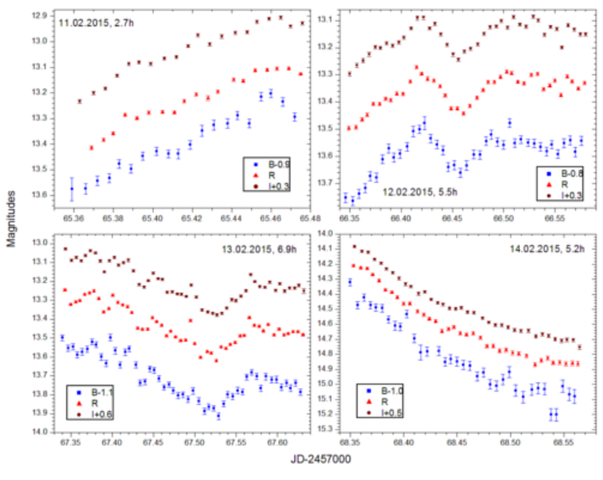












Discussion and conclusions: The color changes on long-term scales that appear almost random imply perhaps the presence of more than one emitting component, each producing different SED and evolving differently. Higher fractional variability during high states implies the presence of multiplicative type interaction between the emitting components (e.g. avalanche type) instead of additive such, when the “fractional variability – average flux” relation should have the opposite trend.

Such and similar studies, especially on very active objects like S4 0954+65, may help significantly to better understand the physics of the relativistic jets. Our monitoring of this object is ongoing.

References:
Bachev R., 2015, MNRAS 451, L21