Spectral changes and BLR kinematics of eruptive changing look AGN

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Summary

▪ optical changing look AGN: Type I ← → Type II

▪ multi-band behaviour (X-ray, UV, optical)

▪ cause for the flux/spectral changes are unknown
  ▪ tidal disruption event (TDE) ?
  ▪ changes in obscuration ?
  ▪ accretion rate instabilities ?

▪ Results:
  ▪ HE 1136-2304 (2014-2017 RM campaign)
    ▪ lightcurve inconsistent with a TDE
    ▪ BLR and continuum stratification
    ▪ BLR structure consistent with that of non-CL AGN
  ▪ NGC 1566
    ▪ extreme changes in Balmer/high-ionization lines
**HE 1136-2304**

- variable X-ray source
  - ROSAT 1990
  - Swift 2012 (ratio ~13)
  - XMM 2014 (ratio ~10)
  - Swift 2014 (ratio ~30)

- follow-up observations with Swift (X-ray, UV), SALT (opt. spectroscopy), Vysos 16, Best II and MONET

- spectral type (1993 → 2014): Sy2 → Sy1
- FWHM(Hα) < FWHM(Hβ)
- RMS: strong red components, weaker blue components
- combined light curves of several instruments
- no systematic trends in both B- and V-band light curves
- TDE excluded as cause of the spectral changes
- time-lags $\tau$ between continuum and lines constrain BLR
SALT lightcurves and 1D-CCFs
Time-lags (SALT) of the lines w.r.t to the optical continuum

<table>
<thead>
<tr>
<th>Line</th>
<th>$\tau$ (days)</th>
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</thead>
<tbody>
<tr>
<td>H$\alpha$</td>
<td>15.0$^{+4.2}_{-3.8}$</td>
</tr>
<tr>
<td>H$\beta$</td>
<td>7.5$^{+4.6}_{-5.7}$</td>
</tr>
<tr>
<td>He I $\lambda$5876</td>
<td>7.3$^{+2.8}_{-4.4}$</td>
</tr>
<tr>
<td>He II $\lambda$4686</td>
<td>3.0$^{+5.3}_{-3.7}$</td>
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Time-lags between combined/NB H$\alpha$ and different B-band continua

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</tr>
</thead>
<tbody>
<tr>
<td>H$\alpha$ SALT/Cont. $B_{\text{comb}}$</td>
<td>16.7$^{+2.3}_{-5.5}$</td>
</tr>
<tr>
<td>H$\alpha$$_{\text{comb}}$/Cont. 4570 Å</td>
<td>13.7$^{+2.9}_{-5.0}$</td>
</tr>
<tr>
<td>$NB_{670}$/Cont. $B_{\text{Bochum}}$</td>
<td>10.8$^{+3.7}_{-3.7}$</td>
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- stratification of the BLR
- line-wing origin at smaller radii than central region
- photometric RM consistent
  - autocorrelation present

DCF of photometric RM-campaign
- modelling of BLR gas
- turbulence + rotation
- result: bowl-shaped BLR
- BLR of HE 1136-2304 fits the bowl-shape structure

- inter-continua time-delays
- several continuum regions?
NGC 1566 - a periodic changing look galaxy?

- close face-on spiral (z=0.005)
- repeated CL AGN
- periodic outbursts?
- recent outburst June 2018
- recent outburst May 2019

- RM campaign with SALT in 2012 - 2013 (low state)
- ToO (SALT) on 2018 July 17th
Summary & Outlook

- **HE 1136-2304**
  - AD-dominated BLR
  - stratification of BLR
  - stratification of continuum (X-rays, UV, optical)
  - outburst no TDE-event

- **NGC 1566**
  - strong continuum changes
  - strong line changes

- **PKS 1020-103** (to be continued...)
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хвала на слушању