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V346 Normae: First post-outburst observations of an FU Orionis star ⋆

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ABSTRACT
During their formation phase stars gain most of their mass in violent episodic accretion events, such as observed in FU Orionis (FUor) and EXor stars. V346 Normae is a well-studied FUor that underwent a strong outburst beginning in ~ 1980. Here, we report photometric and spectroscopic observations which show that the visual/near-infrared brightness has decreased dramatically between the 1990s and 2010 ($\Delta R \approx 10.9^{\rm m}$, $\Delta J \approx 7.8^{\rm m}$, $\Delta K \approx 5.8^{\rm m}$). The spectral properties of this fading event cannot be explained with variable extinction alone, but indicate a drop in accretion rate by 2-3 orders of magnitude, marking the first time that a member of the FUor class has been observed to switch to a very low accretion phase. Remarkably, in the last few years (2011-2015) V346 Nor has brightened again at all near-infrared wavelengths, indicating the onset of a new outburst event. The observed behaviour might be consistent with the *clustered luminosity bursts* that have been predicted by recent gravitational instability and fragmentation models for the early stages of protostellar evolution. Given V346 Nor's unique characteristics (concerning outburst duration, repetition frequency, and spectroscopic diagnostics), our results also highlight the need for revisiting the FUor/EXor classification scheme.

Key words: stars: pre-main sequence – stars: variables: T Tauri, Herbig Ae/Be – stars: individual (V346 Nor) – accretion, accretion discs –

1 INTRODUCTION

FU Orionis stars (FUors) are pre-main-sequence stars that undergo optical outbursts, interpreted as extremely active phases of mass accretion ($\sim 10^{-4}\,{\rm M}_\odot\,{\rm yr}^{-1}$). These sources are classified by the observation of outbursts that increase the optical/infrared brightness by up to 6 mag for several decades as well as their spectroscopic characteristics, which include CO overtone bandhead 2.3 μm absorption and P Cygni Hα profiles that point towards strong outflow activity (for a recent review see Audard et al. 2014). Only about a dozen stars are generally considered to belong to the FUor class, with a few more dozen FUor candidates. Besides their extremely high accretion luminosities, FUor outbursts are characterized by their very long outburst durations (estimated to $\sim 10^2 ... 10^3$ years; Hartmann & Kenyon 1996) - in fact the commonly accepted FUor members are still in outburst since their discovery decades ago, including the prototype FU Orionis itself. The long outburst durations are also used to separate FUors from the EXors, which are eruptive stars of shorter outburst decay time (months to few years) and with lower accretion rates ($\sim 10^{-6}\,{\rm M}_\odot\,{\rm yr}^{-1}$, Herbig 1989).

V346 Normae is in the Sa 187 cloud at a distance of 700 pc and is generally considered to be a genuine member of the FUor class (Prusti et al. 1993; Reipurth et al. 1997). Outburst activity of V346 Nor was first discovered in 1983 when Graham & Frogel (1985) reported the appearance of a star-like object in the visible ($V = 16$ mag). Ábrahám et al. (2004) compiled the light curve and concluded that the near-infrared brightness was increasing continuously throughout the 1990s. The FUor classification is also based on the detection of strong Li I absorption, a P Cygni-like Hα profile, and the detection of strong water vapour absorption around 1.9 μm (Reipurth 1985).

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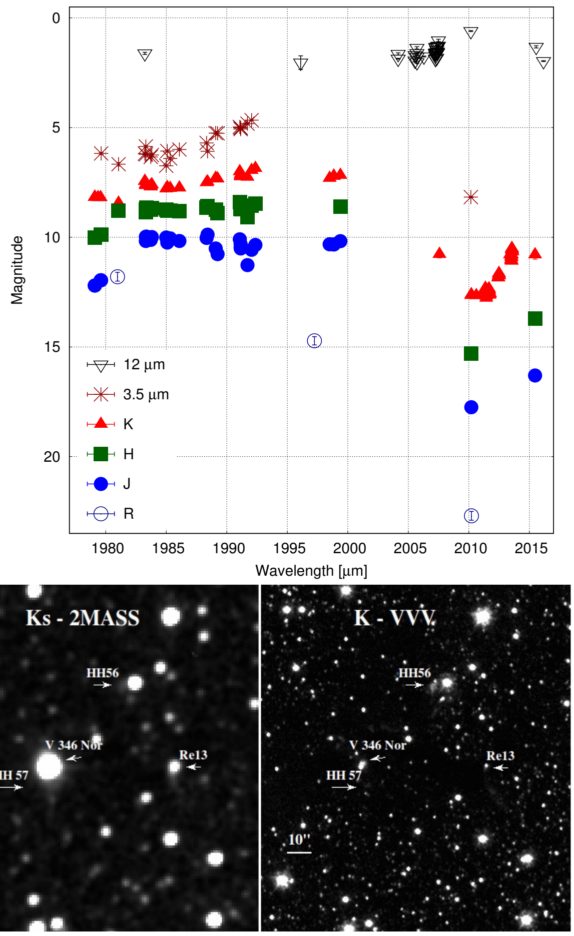

Figure 1. Top: Lightcurve of V346 Nor, including R/J/H/K-band and 3.5 and 12 μm. Bottom: The field around V346 Nor in outburst (left column; 1999, 2MASS) and in the low-accretion phase (right column; 2011, VVV).

Here, we report photometric observations (Sect. 2) which show that V346 Nor has experienced a dramatic drop in visual/infrared excess, indicating that the object has switched from a high-accretion to a low-accretion phase. We discuss our observed dramatic variability in Sect. 3 and close with a summary and discussion on the broader implications of our study in Sect. 4.

2 OBSERVATIONS

We construct the lightcurve of V346 Nor using the following near- and mid-infrared imaging and spectroscopy data:

- VLT/SINFONI (2007-07-28, Eisenhauer et al. 2003): Integral field spectroscopy, covering the K-band with spectral resolution $R = 4000$ and pixel sizes of 25 and 250 mas/pixel.
- Magellan/FIRE (2011-03-16, Simcoe et al. 2008): Echelle spectroscopy, covering the J/H/K-band with $R = 8000$ (0.45″ slit). We also recorded J-band acquisition images on V346 Nor and standard stars. These were used to check for slit losses that might have affected the absolute flux calibration.
- VLT/XSHOOTER (2015-06-20, Vernet et al. 2011): Echelle mode spectroscopy, covering the J/H/K-band with

Table 1. Photometry on V346 Nor

Epoch	Band	Magnitude/Flux	Ref.
1980-12-22	R	11.8	mon98
1997-03-30	R	14.72 ± 0.19	las08
1979-02-01	J	12.20 ± 0.08	mol93
1979-02-11	J	12.20 ± 0.05	gra85
1979-08-??	J	11.96 ± 0.08	rei83
1983-04-25	J	10.17 ± 0.03	rei85
1983-04-25	J	9.98 ± 0.05	gra85
1983-05-10	J	9.97 ± 0.05	gra85
1983-09-19	J	10.08 ± 0.05	gra85
1983-09-21	J	10.12 ± 0.05	gra85
1983-10-23	J	9.99 ± 0.05	gra85
1985-01-01	J	10.01 ± 0.02	mol93
1985-02-01	J	10.24 ± 0.02	mol93
1985-05-01	J	10.05 ± 0.02	mol93
1986-02-01	J	10.17 ± 0.02	mol93
1988-05-01	J	10.03 ± 0.02	mol93
1988-06-01	J	9.88 ± 0.02	mol93
1989-02-01	J	10.51 ± 0.02	mol93
1989-03-30	J	10.77 ± 0.03	mol93
1991-01-27	J	10.09 ± 0.01	mol93
1991-02-22	J	10.31 ± 0.02	mol93
1991-02-22	J	10.47 ± 0.01	mol93
1991-02-26	J	10.51 ± 0.01	mol93
1991-09-18	J	11.27 ± 0.04	mol93
1992-01-20	J	10.57 ± 0.02	mol93
1992-05-13	J	10.35 ± 0.01	pru93
1998-07-01	J	10.318 ± 0.060	den05
1998-11-03	J	10.327 ± 0.070	den05
1999-05-20	J	10.178 ± 0.025	cut03
2010-03-16	J	17.749 ± 0.076	min10
2015-06-20	J	16.3 ± 0.2	XSHOOTER
1979-02-01	H	10.01 ± 0.07	mol93
1979-02-11	H	10.01 ± 0.05	gra85
1979-08-??	H	9.87 ± 0.03	rei83
1981-01-23	H	8.78 ± 0.13	rei85
1983-04-25	H	8.74 ± 0.02	rei85
1983-04-25	H	8.86 ± 0.05	gra85
1983-05-10	H	8.65 ± 0.05	gra85
1983-09-19	H	8.67 ± 0.05	gra85
1983-09-21	H	8.73 ± 0.05	gra85
1983-10-23	H	8.68 ± 0.05	gra85
1985-01-01	H	8.73 ± 0.02	mol93
1985-02-01	H	8.79 ± 0.02	mol93
1985-05-01	H	8.78 ± 0.02	mol93
1986-02-01	H	8.80 ± 0.02	mol93
1988-05-01	H	8.64 ± 0.02	mol93
1988-06-01	H	8.57 ± 0.02	mol93
1989-02-01	H	8.75 ± 0.02	mol93
1989-03-30	H	8.90 ± 0.02	mol93
1991-01-27	H	8.39 ± 0.01	mol93
1991-02-22	H	8.59 ± 0.02	mol93
1991-02-22	H	8.70 ± 0.01	mol93
1991-02-26	H	8.72 ± 0.02	mol93
1991-09-18	H	9.08 ± 0.03	mol93
1992-01-20	H	8.56 ± 0.01	mol93
1992-05-13	H	8.46 ± 0.01	pru93
1999-05-20	H	8.599 ± 0.031	cut03
2010-03-16	H	15.289 ± 0.017	min10
2015-06-20	H	13.7 ± 0.2	XSHOOTER
1983-04-25	K	7.64 ± 0.01	rei85
1983-04-25	K	7.59 ± 0.05	gra85
1983-05-10	K	7.56 ± 0.05	gra85

Table 1 – *continued*

Epoch	Band	Magnitude/Flux	Ref.
1983-09-19	K	7.66 ± 0.05	gra85
1983-09-21	K	7.70 ± 0.05	gra85
1983-10-23	K	7.61 ± 0.10	gra85
1985-01-01	K	7.79 ± 0.02	mol93
1985-02-01	K	7.73 ± 0.02	mol93
1985-05-01	K	7.77 ± 0.02	mol93
1986-02-01	K	7.75 ± 0.02	mol93
1988-05-01	K	7.51 ± 0.02	mol93
1988-06-01	K	7.48 ± 0.02	mol93
1989-02-01	K	7.31 ± 0.02	mol93
1989-03-30	K	7.34 ± 0.01	mol93
1991-01-27	K	7.01 ± 0.01	mol93
1991-02-22	K	7.14 ± 0.02	mol93
1991-02-22	K	7.21 ± 0.01	mol93
1991-02-26	K	7.24 ± 0.01	mol93
1991-09-18	K	7.26 ± 0.03	mol93
1992-01-20	K	6.95 ± 0.01	mol93
1992-05-13	K	6.86 ± 0.01	pru93
1998-07-01	K	7.312 ± 0.070	den05
1998-11-03	K	7.215 ± 0.070	den05
1999-05-20	K	7.176 ± 0.021	cut03
2007-07-28	K	10.78 ± 0.16	SINFONI
2010-03-15	K	12.615 ± 0.003	min10
2010-03-16	K	12.649 ± 0.010	min10
2010-08-14	K	12.662 ± 0.004	min10
2011-05-13	K	12.33 ± 0.05	min10
2011-05-14	K	12.38 ± 0.06	min10
2011-05-16	K	12.33 ± 0.06	min10
2011-05-17	K	12.39 ± 0.06	min10
2011-05-30	K	12.59 ± 0.05	min10
2011-06-09	K	12.68 ± 0.06	min10
2011-08-18	K	12.38 ± 0.05	min10
2011-08-23	K	12.43 ± 0.08	min10
2011-08-31	K	12.492 ± 0.05	min10
2011-09-01	K	12.35 ± 0.06	min10
2011-09-01	K	12.513 ± 0.05	min10
2011-09-02	K	12.42 ± 0.06	min10
2011-09-19	K	12.635 ± 0.05	min10
2011-09-20	K	12.55 ± 0.06	min10
2011-10-02	K	12.57 ± 0.06	min10
2012-06-05	K	11.85 ± 0.05	min10
2012-06-05	K	11.84 ± 0.05	min10
2012-06-20	K	11.75 ± 0.05	min10
2012-06-21	K	11.75 ± 0.05	min10
2012-06-27	K	11.65 ± 0.06	min10
2012-06-27	K	11.66 ± 0.06	min10
2012-06-30	K	11.74 ± 0.06	min10
2013-05-27	K	$10.8 \pm 0.0.1$	min10
2013-06-27	K	10.77 ± 0.05	min10
2013-06-28	K	11.06 ± 0.05	min10
2013-06-30	K	11.01 ± 0.05	min10
2013-07-01	K	10.90 ± 0.05	min10
2013-07-02	K	10.88 ± 0.05	min10
2013-07-14	K	10.92 ± 0.06	min10
2013-07-17	K	11.09 ± 0.06	min10
2013-07-20	K	10.52 ± 0.06	min10
2013-07-21	K	10.51 ± 0.06	min10
2013-07-21	K	10.59 ± 0.06	min10
2013-07-22	K	10.81 ± 0.06	min10
2013-07-25	K	10.55 ± 0.09	min10
2013-07-28	K	10.66 ± 0.08	min10
2013-07-31	K	10.65 ± 0.05	min10
2015-06-20	K	10.8 ± 0.2	XSHOOTER

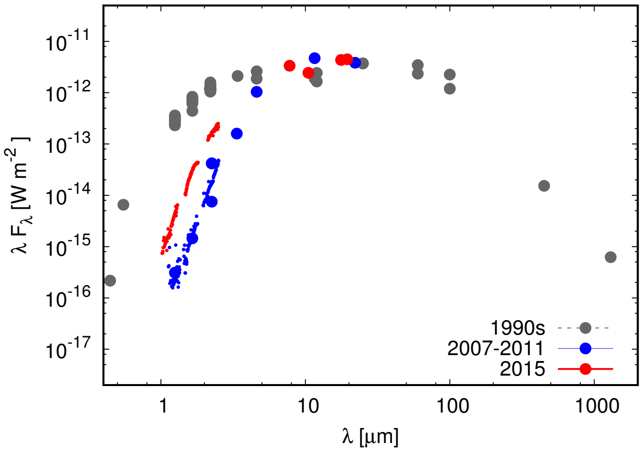

Figure 2. SED measured at three epochs (1990s, 2007-2011, 2015).

Table 1 – *continued*

Epoch	Band	Magnitude/Flux	Ref.
1979-08-??	3.5 μm	6.18 ± 0.03	rei83
1981-01-23	3.6 μm	6.57 ± 0.08	rei85
1983-03-26	3.5 μm	6.19 ± 0.05	gra85
1983-04-25	3.5 μm	5.86 ± 0.05	rei85
1983-04-25	3.5 μm	6.22 ± 0.05	gra85
1983-09-21	3.5 μm	6.34 ± 0.05	gra85
1983-10-23	3.5 μm	6.25 ± 0.05	gra85
1985-01-01	3.5 μm	6.74 ± 0.05	mol93
1985-02-01	3.5 μm	6.07 ± 0.05	mol93
1985-05-01	3.5 μm	6.41 ± 0.05	mol93
1986-02-01	3.5 μm	6.00 ± 0.05	mol93
1988-05-01	3.5 μm	5.70 ± 0.05	mol93
1988-06-01	3.5 μm	6.08 ± 0.05	mol93
1989-02-01	3.5 μm	5.25 ± 0.05	mol93
1989-03-30	3.8 μm	5.26 ± 0.09	mol93
1991-01-27	3.8 μm	4.97 ± 0.02	mol93
1991-02-22	3.8 μm	5.01 ± 0.02	mol93
1991-02-22	3.8 μm	5.07 ± 0.01	mol93
1991-02-26	3.8 μm	5.02 ± 0.02	mol93
1991-09-18	3.8 μm	4.82 ± 0.04	mol93
1992-01-20	3.8 μm	4.66 ± 0.01	mol93
2010-03-01	3.35 μm	0.177 ± 0.005 Jy	cut14
2010-03-01	4.6 μm	1.59 ± 0.09 Jy	cut14
2010-03-01	11.6 μm	18.2 ± 0.4 Jy	cut14
2004-02-27	12 μm	7.18 Jy	IRS
2005-07-21	12 μm	6.6 ± 0.3 Jy	MIDI
2005-09-16	12 μm	9.0 ± 0.4 Jy	MIDI
2005-09-18	12 μm	6.2 ± 0.3 Jy	MIDI
2006-04-16	12 μm	7.87 Jy	IRS
2007-03-30	12 μm	7.2 ± 0.4 Jy	MIDI
2007-03-30	12 μm	7.1 ± 0.4 Jy	MIDI
2007-04-09	12 μm	9.1 ± 0.5 Jy	MIDI
2007-04-10	12 μm	9.3 ± 0.5 Jy	MIDI
2007-04-10	12 μm	8.3 ± 0.4 Jy	MIDI
2007-05-06	12 μm	7.4 ± 0.4 Jy	MIDI
2007-05-28	12 μm	9.6 ± 0.5 Jy	MIDI
2007-05-28	12 μm	9.2 ± 0.5 Jy	MIDI
2007-06-27	12 μm	12.3 ± 0.6 Jy	MIDI
2015-07-25	12 μm	11.7 ± 0.5 Jy	VISIR
2010-03-01	22.1 μm	28.259 ± 0.16 Jy	cut14

Table 1 – *continued*

Epoch	Band	Magnitude/Flux	Ref.
2010-03-19	B	< 23.6 [a]	IMACS
2010-03-19	V	< 23.3 [a]	IMACS
2010-03-19	R	22.7 ± 0.2	IMACS
2015-07-25	$7.78\,\mu$m	8.7 ± 0.5 Jy	VISIR
2015-07-25	$10.49\,\mu$m	8.5 ± 0.5 Jy	VISIR
2015-07-25	$17.65\,\mu$m	25.6 ± 0.5 Jy	VISIR
2015-07-25	$19.50\,\mu$m	29.1 ± 0.5 Jy	VISIR
2016-02-29	$12\,\mu$m	6.5 ± 0.2 Jy	VISIR

Notes – [a] The source has not been detected in these images, therefore we provide upper limits. *References* – The photometric data has been taken from the following references (while new measurements are referenced with the instrument name): rei83: Reipurth & Wamsteker (1983); rei85: Reipurth (1985); gra85: Graham & Frogel (1985); mol93: Molinari et al. (1993); mon98: Monet (1998); cut03: Cutri et al. (2003, 2MASS); den05: DENIS consortium (September 2005); las08: Lasker et al. (2008, GSC2.3.2) min10: Minniti et al. (2010, VVV); cut14: Cutri & et al. (2014, WISE)

$R = 10,500$ (slit size of $0.4''$ in the near-infrared a rm). Additional data was taken with a wide $5''$ slit and used for the photometric calibration to avoid slit losses.

- VLT/VISIR (2015-07-25, Lagage et al. 2004): Imaging in a J7.9 ($7.78 \pm 0.55\,\mu$m), SiV ($10.49 \pm 0.16\,\mu$m), Q1 ($17.65 \pm 0.83\,\mu$m), and Q3 ($19.50 \pm 0.40\,\mu$m) filter.
- VLT/VISIR (2016-02-29): Long-slit spectroscopy, covering the N-band with $R = 350$.
- VLTI/MIDI (2005-07-22/24, 2005-09-17/19, 2007-03-31, 2007-04-10/11, 2007-05-06/29, 2007-06-28, 2007-07-24): Mid-infrared interferometry, covering the N-band with $R = 30$. Photometry frames were recorded both on V346 Nor and the calibrator stars, allowing us to retrieve absolute fluxes.
- Magellan/IMACS (2011-03-19): Wide-field imaging in the B/V/R-band with a pixel size of $0.11''$/pixel.

We reduced the SINFONI, XSHOOTER, and VISIR data using the standard ESO instrument pipelines (versions 2.7.0, 2.6.8, and 4.1.7, respectively), while the MIT data reduction pipeline was used to extract the FIRE spectrum. All spectroscopic observations were accompanied by standard star observations (2007-07-28: HD139579; 2011-03-16: HD103125; 2015-06-20: HIP85885, HR6572; 2015-07-25, 2015-08-08: HD178345; 2016-02-29: HD149447, HD151680), which allows us to flux-calibrate the spectra. The MIDI data was reduced using the MIA+EWS software (Release 2.0; Jaffe 2004; Leinert et al. 2004) and observations on the calibrator stars HD152820, HD220704, HD163376, HD146791, HD160668, and HD138816 were used to extract absolute-calibrated photometry.

In this paper, we use the derived spectra to build the lightcurve (Figs. 1, top). The line emission signatures and interferometry results will be discussed in a future paper (Kraus et al., in prep.).

We also include photometry from Reipurth & Wamsteker (1983); Reipurth (1985); Graham & Frogel (1985); Molinari et al. (1993), Minniti et al. (2010, VVV), Cutri & et al. (2014, WISE), the USNO, GSC2, 2MASS, and DENIS catalogue, and Spitzer/IRS spectroscopy (AORKEY 3570688+16260864; first epoch published in Green et al. 2006). The derived photometry measurements are listed in Tab. 1, together with a compilation of measurements from the literature.

3 RESULTS

Our lightcurve (Fig. 1, top) shows that the near-infrared magnitude of V346 Nor dropped by $\Delta K = 5.8$ mag, $\Delta J = 7.8$ mag, and $\Delta R = 10.9$ mag between the late 1990s and 2011. The dramatic drop in brightness is also illustrated in Fig. 1 (bottom), where we compare images from 1999 and 2011. From this data, we construct the spectral energy distribution (SED) in the outburst (1990s), near the photometric minimum (2007-2011), and in the latest brightening phase (2015), as shown in Fig. 2.

In order to explain the observed dramatic photometric variability, we consider changes in the outburst properties of V346 Nor, or, alternatively, in the line-of-sight extinction. We find that variable extinction alone is not sufficient to explain the observed spectral slope, as the change in colour between the high and low-accretion phase is much too shallow to be consistent with dust extinction. Between 1997/98 and 2010 the K-band magnitude dropped by $\Delta K = 5.3$ with remarkably blue colours of $\Delta(J-K) = 2.1$ and $\Delta(R-K) = 2.6$. Dust extinction would result in much redder colours, e.g. $\Delta(J-K) = 7.8$ and $\Delta(R-K) = 36.6$ for the small ISM-like dust population ($0.1\,\mu$m Silicate grains) that was detected around V346 Nor (Schütz et al. 2005). We also tested scenarios with a large dust grain-population (e.g. 10μm grains: $\Delta(J-K) = 4.6$, $\Delta(R-K) = 16.6$), with a power-law grain size distribution, and dust grain mixtures, but were not able to reproduce the observed very blue colours with extinction alone. This finding is also consistent with the fact that the Silicate absorption feature does not exhibit any significant changes in our 2005+2006+2007+2015+2016 mid-infrared spectra compared to the outburst phase (Schütz et al. 2005; Quanz et al. 2007), indicating that the line-of-sight extinction remained unchanged.

We propose that the observed fading event was caused by a dramatic drop in accretion luminosity. We estimate the corresponding change in accretion rate by integrating the short-wavelength SED covered by our observations ($\lambda \lesssim 25\,\mu$m) during the outburst phase (1990s) and near the photometric minimum (2010). A major uncertainty concerns the line-of-sight extinction, where Audard et al. (2014) proposed $A_V > 12$ mag. This value is higher than some earlier estimates (e.g. $5.6^{+4.1}_{-3.7}$ mag, Connelley & Greene 2010), but supported by our SINFONI data, where H_2 1-0 line transitions detected in the vicinity of V346 Nor favour very high extinction values (details will be outlined in Kraus et al., in prep.). Also, the J/H/K-band colours measured in the low-accretion phase are consistent with those of a classical T Tauri star for extinction values of $A_V = 20 \pm 5$ mag. Adopting the lower-limit value of $A_V = 12$ mag implies that the accretion luminosity and mass accretion rate changed by two orders-of-magnitudes, while $A_V = 15$ mag implies a change by $\sim 10^3$.

These estimates suggest that V346 Nor switched from an FUor outburst (with $\dot{M} \sim 10^{-4}\,M_\odot\,yr^{-1}$) to a rather passive phase with accretion rates similar to those observed towards T Tauri stars ($\sim 10^{-7}\,M_{\odot}\,yr^{-1}$). Remarkably, in the last few years (2011-2015), the object has brightened again at all near-infrared wavelengths, indicating that the object has entered a new outburst event. This is the first time that an FUor has been observed to switched between active-passive-active phases, although further monitoring will be needed to determine whether the new eruption will reach again the extreme accretion state of the 1980s/1990s.

The near-infrared variability is also accompanied by changes in the mid-infrared flux, where we observe an anti-correlated variability. For instance, during the near-infrared fainting event between 2004 and 2007 the 8-13 μm mid-infrared continuum flux increased by $\sim$ 50% between 2004 and 2007. During the new near-infrared brightening event in 2015/2016 at near-wavelength wavelengths, the mid-infrared flux decreased again by $\sim$ 70%. This anti-correlated behaviour might provide important clues about how the intermediate disc regions responsed to the dramatic change in accretion luminosity.

4 DISCUSSION AND CONCLUSIONS

Our study shows that V346 Nor has switched from an extreme FUor-type outburst into a much less active phase, consistent with a change in the accretion rate by 2-3 orders of magnitude. With $\Delta R = 10.9$ mag and $\Delta K = 5.8$ mag, the observed dimming event far exceeded the variability that has been observed on other FUors before (e.g. $\Delta R \approx 3$ mag, V899 Mon; Ninan et al. 2015).

Therefore, V346 Nor opens for the first time the opportunity to study an FUor system in post-outburst and to investigate how the disc adjusted to the sudden drop in accretion luminosity. For instance, some valuable insights might arise from modelling the observed anti-correlated variability at near-infrared/mid-infrared wavelengths. Also, the short-wavelength flux (R-band) started to decay a few year ahead of the near-infrared flux (e.g. J/H/K-band; Fig. 1, top), which might indicate that the disc needed a few years to react to the sudden drop in accretion luminosity.

With an outburst duration of 20...25 years, the V346 Nor outburst was shorter than expected for FUors (10^2...10^3 years), but significantly longer than for EXor (up to a few years). This suggests that eruptive stars might not be well-represented by the classical bimodal FUor/EXor classification scheme, but exhibit a more continuous range of properties. Already a few other objects with "intermediate" outburst durations of a few years have been identified (Audard et al. 2014; Contreras Peña et al. 2016) and started to blur the conventional distinctions between the FUor/EXor class. However, V346 Nor represents the most extreme case, in particular as the object entered already into a new outburst, less than a decade after the decay of its FUor-type eruption. This recurrence cycle is orders-of-magnitudes shorter than the typical time span of ~5000...50,000 years that has been proposed for classical, isolated FUor outbursts (Scholz et al. 2013), but might be consistent with the *clustered luminosity bursts* that have been predicted by recent disc gravitational instability and fragmentation models for the earliest stages of protostellar evolution (e.g. Vorobyov & Basu 2015).

Besides its atypical lightcurve, V346 Nor is also ambiguous in its spectral diagnostics, as it features Brγ and the CO 2.3 μm bandheads in emission (Reipurth et al. 1997), which is more commonly observed in EXors than FUors (e.g. Lorenzetti et al. 2006).

With its unique characteristics concerning outburst duration, repetition frequency, and spectroscopic diagnostics, V346 Nor provides important new insights on the relation between the FUor and EXor phenomenon and might help to identify their triggering mechanism(s).

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