Visually Observing Quasars

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Background

Quasars are very distant objects in the observable Universe. Bright quasars are visible in amateur telescopes.

In the 1950s, when first observing the celestial sphere in radio frequencies, invisible objects or “quasi-stellar radio sources” were discovered with intense signals. With many radio-quiet quasars discovered, we now generally use quasi-stellar object (QSO).

Today, we believe a quasar indicates the accretion of material surrounding a super-massive black hole at the heart of an active galaxy. The gravity well driving the massive energy production requires millions or billions of solar masses. Galaxies with a high bulge mass will have a high black-hole mass. Our Milky Way core is not a quasar, as the black hole has insufficient fuel. Active galaxy M87 with its 3.5 billion solar-mass black hole is still not large enough.

Quasars are ancient objects, typically 12 billion years old. Due to the metric expansion of spacetime, they show high redshift values (z). The z property of 3.6 is equivalent to a light travel time of 10 billion years (Gy).

Exceeding the light of the host galaxy, sometimes by a factor of a million, we can detect quasars despite the great distances. Many have optical wavelength emissions visible in amateur telescopes, thus representing the furthest objects that can be seen.

Wikipedia features extensive information on the discovery, history, properties, and positional qualities of quasars.

Technique

Telescopically, a quasar will appear star-like while the host galaxy may be invisible. Though intrinsically brilliant, these redshifted point-sources are dim in the eyepiece. To visually identify a QSO, you will need appropriate equipment under excellent conditions in a dark-sky location.

4U 0241+61 in Pisces at mag. 12.2 is within reach of an 80-mm telescope. Many mag. +13 subjects will be in the grasp of a 200-mm scope. On the other hand, B 1422+231 in Boötes at

mag. 16.1 will be a challenge in a ½-metre instrument. Faint targets will have you working at the theoretical detection limits of your telescope, ocular, and eye.

High magnification is useful. Once you have verified the star field, use averted vision working at a magnification as high as your telescope and seeing conditions permit.

Whether one uses a Go-To telescope or star hops to the region of interest, there is the matter of field identification, picking out an extremely faint star-like object from the background. Paper charts may not go deep enough if you require mag.-16 and 17 stars. Employ advanced astronomy software (e.g. *SkyTools* or *Cartes du Ciel*) or web resources (e.g. SIMBAD or DSO Browser).

Case Study

Best viewed in late-April in the Northern Hemisphere, 3C 273.0 (aka Q1226+0023) is an easy quasar in Virgo. It is magnitude 12.8, not far from Porrima and eta Virginis (Figure 1), almost exactly between stars FW and 16. It is near star SAO 119431. It is nestled inside an L-shape of faint stars with mag.-10 PPM 158889 (Figure 2).

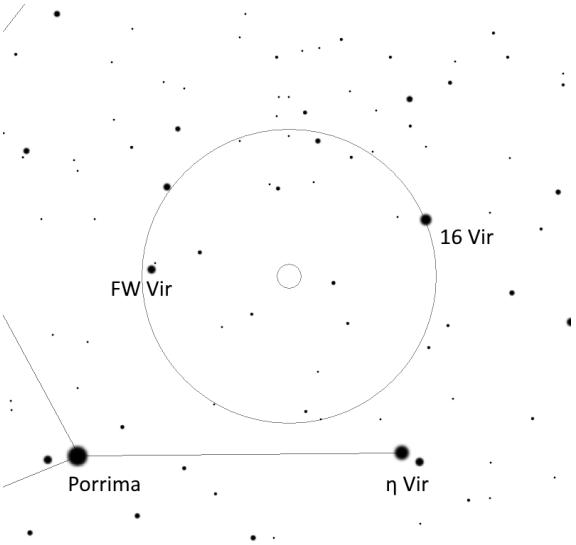

Figure 1. Wide view in Virgo. Large circle represents a 5.0-degree finder-scope field. Start from bright double star Porrima aka gamma Virginis. Starhop using eta, FW, and 16 Vir.

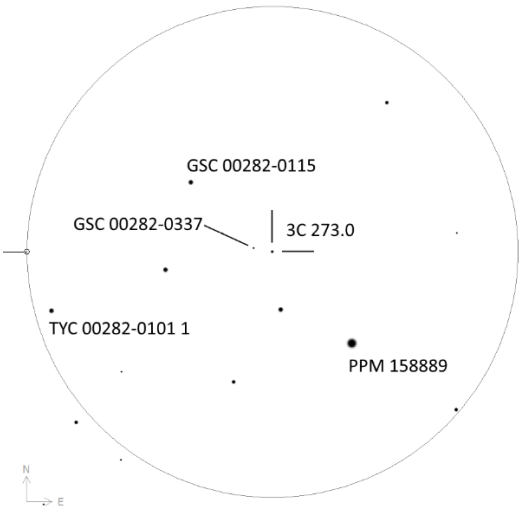

Figure 2. Telescopic view with mirror or star diagonal. North is up; east is right. True field of view is approximately 22 arcminutes at 225 power. Identify the field with mag.-12 stars GSC 00282-0115 and Tycho 00282-0101 1 with mag. 10 PPM 158889. Nearby GSC 00282-0337 west of the quasar is mag 13.

Suggested Targets

There are a number of quasars suitable for modest amateur telescopes. We present a short list arranged from bright to dim. Crude coordinates are provided to get you in the neighbourhood.

Name	**Mag. mv**	**Const.**	**RA** (2000) **h m**	**Dec ° '**	**z**	**Gy**	**Comments**
4U 0241+61	12.2	Psc	00 01	+00 06	0.04	0.6	Brightest.
3C 273	12.8	Vir	12 30	+01 58	0.16	1.9	Early discovery.
PHL 1811	13.9	Cap	21 56	-09 18	0.19	2.2	Fairly easy.
Markarian 231	14.4	UMa	12 57	+56 47	0.04	0.6	Nearest in UGC 8058.
HS 1626+6433	15.9	Dra	16 27	+ 64 25	2.32	9.2	Challenging.
3C 48	16.2	Tri	01 39	+33 15	0.40	3.7	Early discovery.
QSO B 1422+231	16.1	Boo	14 25	+22 56	3.62	10.0	Visible in amateur ‘scope!

Gy is the “look back” time, in billions of years. Consider seeing so far back in time, well before life on Earth, before the formation of our Solar System, back when the Universe was young at 4 billion years old.

References

Wikipedia. https://en.wikipedia.org/wiki/Quasar
SkyTools. http://skyhound.com/
Cartes du Ciel. http://ap-i.net/skychart/en/start
SIMBAD. http://simbad.u-strasbg.fr/simbad/
DSO Browser. https://dso-browser.com/
Catalogue of Bright Quasars and BL Lacertae Objects www.klima-luft.de/steinicke/KHQ/khq_e.htm