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Abstract

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1 Section Heading

Recent large quasar surveys have allowed us to study the properties of the quasar population with unprecedented statistical precision. The number of known quasars has increased nearly 100-fold since the late 1990s, (for photometrically identified quasars, see Richards et al., 2009) and since that time, there has been a large effort to measure the QLF in the UV/optical (Boyle et al., 2000; Fan et al., 2001; Wolf et al., 2003; Hunt et al., 2004; Fan et al., 2004; Croom et al., 2004; Hao et al., 2005; Richards et al., 2005, 2006; Fan et al., 2006; Jiang et al., 2006; Fontanot et al., 2007; Bongiorno et al., 2007; Reyes et al., 2008; Jiang et al., 2008, 2009; Croom et al., 2009a; Glikman et al., 2010; Willott et al., 2010; Glikman et al., 2011; Ikeda et al., 2011, 2012; Masters et al., 2012), mid-infrared (Brown et al., 2006; Siana et al., 2008; Assef et al., 2011) and the soft and hard X-ray (Cowie et al., 2003; Ueda et al., 2003; Hasinger et al., 2005; Barger et al., 2005; Silverman et al., 2005, 2008; Aird et al., 2008; Treister et al., 2009; Aird et al., 2010; Fiore et al., 2012). An overview of recent determinations of the optical QLF is given in Table 1.

Survey	Area (deg^2)	N_Q	Magnitude Range	z-range	Reference
GOODS(+SDSS)	0.1+(4200)	13(+656)	$22.25 < z_{850} < 25.25$	$3.5 < z < 5.2$	Fontanot et al. (2007)
VVDS	0.62	130	$17.5 < I_{\rm AB} < 24.0$	$0 < z < 5$	Bongiorno et al. (2007)
COMBO-17	0.8	192	$R < 24$	$1.2 < z < 4.8$	Wolf et al. (2003)
COSMOS[a]	1.64	8	$22 < i' < 24$	$3.7 \lesssim z \lesssim 4.7$	Ikeda et al. (2011)
COSMOS	1.64	[b]0	$22 < i' < 24$	$4.5 \lesssim z \lesssim 5.5$	Ikeda et al. (2012)
COSMOS	1.64	155	$16 \leq I_{\rm AB} \leq 25$	$3 < z < 5$	Masters et al. (2012)
NDWFS+DFS[c]	4	24	$R \leq 24$	$3.7 < z < 5.1$	Glikman et al. (2011)
SFQS[d]	4	414	$g < 22.5$	$z < 5$	Jiang et al. (2006)
BOSS[e]+MMT	14.5+3.92	1 877	$g \lesssim 23$	$0.7 < z < 4.0$	Palanque-Delabrouille et al. (2012)
2SLAQ[f]	105	5 645	$18.00 < g < 21.85$	$z \leq 2.1$	Richards et al. (2005)
SDSS[g]	182	39	$i \leq 20$	$3.6 < z < 5.0$	Fan et al. (2001)
SDSS+2SLAQ	192	10 637	$18.00 < g < 21.85$	$0.4 < z < 2.6$	Croom et al. (2009a)
SDSS Main+Deep	195	6	$z_{\rm AB} < 21.80$	$z \sim 6$	Jiang et al. (2009)
BOSS Stripe 82	**220**	**5 476**	$i >$**18.0 and** $g <$**22.3**	**2.2**$< z <$**3.5**	Palanque-Delabrouille et al. (2011)
CFHQS[h]	500	19	$z' < 22.63$	$5.74 < z < 6.42.$	Willott et al. (2010)
2QZ[i]	700	23 338	$18.25 < b_{\rm J} < 20.85$	$0.4 < z < 2.1$	Boyle et al. (2000); Croom et al. (2004)
SDSS DR3	1622	15 343	$i \leq 19.1$ and $i \leq 20.2$	$0.3 < z < 5.0$	Richards et al. (2006)
BOSS DR9	**2236**	[j]**23 201**	$g <$**22.00 or** $r <$**21.85**	**2.2**$< z <$**3.5**	**this paper**
SDSS DR7	6248	57 959	$i \leq 19.1$ and $i \leq 20.2$	$0.3 < z < 5.0$	Shen & Kelly (2012)
SDSS Type 2	6293	887	$L_{\rm OIII} \geq 10^{8.3} L_\odot$	$z < 0.83$	Reyes et al. (2008)
SDSS DR6[k]	8417	$\gtrsim 850{,}000$	$i < 21.3$	$z \sim 2$ and $z \sim 4.25$	Richards et al. (2009)

Table 1: Selected optical quasar luminosity function measurements.
[a]Cosmic Evolution Survey (Scoville et al., 2007).
[b]No Type-1 quasars were identified, though a low-luminosity $z \sim 5.07$ Type-2 quasar was discovered.
[c]NOAO Deep Wide-Field Survey (Jannuzi & Dey, 1999) and the Deep Lens Survey (Wittman et al., 2002).
[d]SDSS Faint Quasar Survey.
[e]The "boss21" area on the SDSS Stripe 82 field.
[f]2dF-SDSS LRG And QSO Survey (Croom et al., 2009b).
[g]Photometric sample from SDSS; spectroscopic confirmation from SDSS and other telescopes.
[h]Canada-France High-z Quasar Survey (Willott et al., 2009)
[i]2dF Quasar Redshift Survey (Croom et al., 2004).
[j]From our "uniform" sample defined in Section **??**
[k]From a catalog of >1,000,000 photometrically classified quasar candidates.

1.1 Subsection heading

The QLF is defined as the number density of quasars per unit luminosity. It is often described by a double power-law (Boyle et al., 2000; Croom et al., 2004; Richards et al., 2006, hereafter, R06) of the form

$$\Phi(L,z) = \frac{\phi_*^{(L)}}{(L/L^*)^\alpha + (L/L^*)^\beta} \tag{1}$$

with a characteristic, or break, luminosity L_*. An alternative definition of this form of the QLF gives the number density of quasars per unit magnitude,

$$\Phi(M,z) = \frac{\phi_*^{(M)}}{10^{0.4(\alpha+1)[M-M^*(z)]} + 10^{0.4(\beta+1)[M-M^*(z)]}} \tag{2}$$

The dimensions of Φ differ in the two conventions. We have followed R06 such that α describes the faint end QLF slope, and β the bright end slope. The α/β convention in some other works (e.g., Croom et al., 2009a) is in the opposite sense from our definition. Evolution of the QLF can be encoded in the redshift dependence of the break luminosity, ϕ_*, and also potentially in the evolution of the power-law slopes.

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