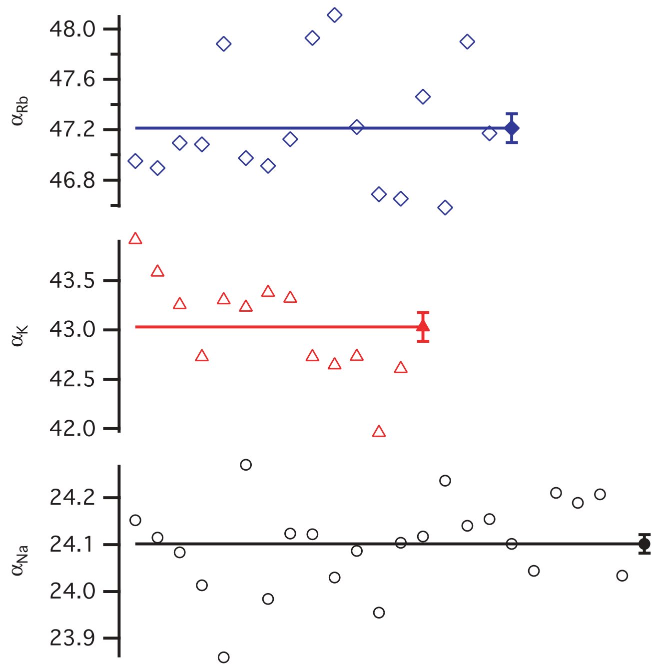

FIG. 5. (Color online) Multiple measurements of the polarizability of sodium (circles), potassium (triangles), and rubidium (diamonds). The mean polarizabilities are denoted by filled markers and lines. The error bars represent the standard error of the mean. Units are 10^{-24} cm^3. Final results are shown in Table I.

The correction to the polarizability from taking into account the isotope ratios is +0.04% for α_K and +0.02% for α_{Rb}.

The result of each data set is shown in Fig. 5. Each point on the plot represents one hour of data. We report the mean polarizability from all of our data in Table I. The reported statistical error is the standard error of the mean and is dominated by the reproducibility of the experiment rather than the statistical phase error of a typical data set. The systematic errors are discussed later.

Since we performed all measurements in the same apparatus under similar beam conditions and without changing any parameters that contribute to systematic error in the polarizability, we can report polarizability ratios with uncertainties dominated by the statistical precision of our measurements. We show our measured polarizability ratios in Table II. Figure 6 shows a summary of measurements [3,13] and calculations [2,22–33] of the polarizability ratios of sodium, potassium, and rubidium, including this work. We added the reported uncertainties for each atom in quadrature to calculate the uncertainty in polarizability ratios for previous work [3,13].

TABLE I. Measured absolute and recommended atomic polarizabilities in units of 10^{-24} cm^3. Our recommended polarizability values are based on our ratio measurements (see Table II) combined with the sodium polarizability measurement from reference [5].

	α_{abs} (stat.)(sys.)	α_{rec}(tot.)
Na	24.11(2)(18)	24.11(8)
K	43.06(14)(33)	43.06(21)
Rb	47.24(12)(42)	47.24(21)

TABLE II. Measured atomic polarizability ratios with statistical uncertainties. Also included are several polarizability ratios from *ab initio* and semi-empirical calculations. See Fig. 6 for more previous calculations and measurements of polarizability ratios.

	α_{ratio} (stat. unc.)			
Atoms	This work	Ref. [2]	Ref. [30]	Ref. [31]
Rb:Na	1.959(5)	1.959(5)	1.946	1.939
K:Na	1.786(6)	1.785(6)	1.779	1.781
Rb:K	1.097(5)	1.098(5)	1.094	1.089

If the reported uncertainties have systematic errors that would have canceled in ratio measurements, then this calculation will lead to an overestimate of the ratio uncertainties.

We calculate our recommended measurements of potassium and rubidium polarizability by combining our polarizability-ratio measurements with the sodium-polarizability measurement by Ekstrom *et al.* [5]. To calculate the total uncertainty of the recommended polarizabilities of potassium and rubidium, we add the total uncertainty of the Ekstrom *et al.* sodium measurement in quadrature with the statistical uncertainty of our appropriate polarizability ratio. Our recommended polarizability values and their total uncertainties are shown in Table I. Given the 0.8% uncertainty of our direct measurement of α_{Na}, the agreement between our measurement and that of Ekstrom *et al.* at the level of 0.04% is coincidental.

Table III shows a summary of the error budget. Most of the highly significant parameters in the error budget are related to the flow velocity v_0 or velocity distribution parameter σ_v. The

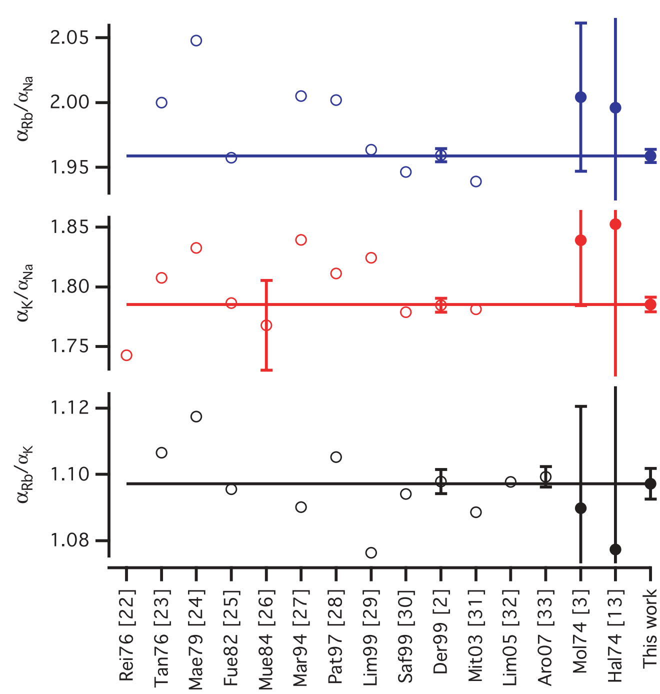

FIG. 6. (Color online) Previously calculated (unfilled) and measured (filled) alkali-metal polarizability ratios. References are denoted by the abbreviated name of the first author, the publication year, and the reference number. Calculations in references [2,33] incorporate state-lifetime measurements.