Supplementary Information:

Facile Oxidation of NHC-Au(I) to Au(III) Complexes by CsBr₃

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Figure S1. Molecular structures of 1a (left) and 1b (right, ellipsoids drawn at the 50% probability level, H atoms omitted for clarity). Selected bond lengths [Å] and angles [°] for 1a: N2–C6 1.334(3), C5–N1 1.250(3), N1–C5–C6 122.4(2), N4–C20 1.333(3), C19–N3 1.259(2), N3–C19–C20 122.8(2); and for 1b: N1–C6 1.339(3), C5–N2 1.257(3), N2–C5–C6 123.63(18).

Figure S2. Cation in crystals of 5b (isotropically refined). Graphic for illustrative reasons and proof of the connectivity of the complex.

Figure S3. Dark red crystals of the neutral gold(III)-complex 5b* and bright red crystals of the cationic gold complex 5b.
Photophysical Characterization of 2a, 4a, 4b

Imidazolium-salt 2a, Au(I) carbene 4a, Au(III) carbene, 5a:

![Graph showing absorption, excitation, and emission spectra of 2a in ethanolic solution at r.t. and 77 K.]

**Figure S4.** Electronic absorption, excitation and emission spectra of 2a in ethanolic solution at r.t. and 77 K.
Figure S5: Electronic absorption, excitation and emission spectra of 4a in ethanolic solution at r.t. and 77 K.

Figure S6: Electronic absorption, excitation and emission spectra of 5a in ethanolic solution at r.t. and 77 K.
Emission Lifetime Measurements of the Au(I)-Carbene complexes at 77 K

Figure S7. Emission decay of 4a in ethanol glass (c = 7.2 $10^{-5}$ M, $\lambda_{\text{exc.}} = 300$ nm, $\lambda_{\text{det.}} = 580$ nm) at 77 K.
**Figure S8.** Emission decay of 4b in ethanol glass (c = 8.5 \(10^{-5}\) M, \(\lambda_{\text{exc.}} = 300\) nm, \(\lambda_{\text{det.}} = 580\) nm) at 77 K.
**Figure S9.** Irradiation of an ethanolic solution of 5a with polychromatic light ($\lambda > 305$ nm).