Table S1. Crystal data and structure refinement for [EMIM][AuCl4].

Identification code	mh22
Empirical formula	C6 H11 Au Cl4 N2
Formula weight	449.93
Temperature	193(2) K
Wavelength	0.71073 A
Crystal system, space group	Monoclinic, P2(1)/c
Unit cell dimensions	a = 11.1915(15) A alpha = 90 deg. b = 12.380(2) A beta = 98.810(16) deg. c = 9.2883(13) A gamma = 90 deg.
Volume	1271.7(3) A^3
Z, Calculated density	4, 2.350 Mg/m^3
Absorption coefficient	12.370 mm^-1
F(000)	832
Crystal size	0.15 x 0.15 x 0.10 mm
Theta range for data collection	1.84 to 22.49 deg.
Index ranges	-11<=h<=12, -13<=k<=13, -9<=l<=9
Reflections collected / unique	6629 / 1656 [R(int) = 0.0459]
Completeness to 2theta = 22.49	94.5%
Min. max. transmission	0.947/0.566
Refinement method	Full-matrix least-squares on F^2
Data / restraints / parameters	1656 / 115 / 132
Goodness-of-fit on F^2	0.974
Final R indices [I>2sigma(I)]	R1 = 0.0219, wR2 = 0.0455
R indices (all data)	R1 = 0.0457, wR2 = 0.0485
Extinction coefficient	0.00043(7)
Largest diff. peak and hole	0.478 and -0.724 e.A^-3

Table S2. Atomic coordinates (x 10^4) and equivalent isotropic displacement parameters (A^2 x 10^3) for [EMIM][AuCl4]. U(eq) is defined as one third of the trace of the orthogonalized Uij tensor.

	x	y	z	U(eq)
Au(1)	0	0	0	16(1)
Au(2)	5000	0	0	26(1)
Cl(1)	239(2)	-1332(2)	1715(3)	33(1)
Cl(2)	105(2)	1290(2)	1766(3)	30(1)
Cl(3)	3005(2)	200(2)	124(3)	58(1)
Cl(4)	5317(2)	-599(2)	2349(2)	45(1)
N(1)	2544(6)	1178(5)	4341(8)	29(2)
N(2)	2099(7)	-410(5)	5036(7)	31(2)
C(1)	2746(8)	137(7)	4195(8)	31(2)
C(2)	1775(9)	1301(8)	5316(10)	35(2)
C(3)	1497(9)	316(7)	5748(9)	39(3)
C(4)	3088(10)	2044(7)	3592(12)	60(3)
C(5)	2088(11)	-1591(7)	5220(12)	52(3)
C(6)	2990(16)	-1999(11)	6360(2)	71(7)
C(6')	3220(3)	-2090(3)	5130(7)	80(12)

Table S3. Bond lengths [A] and angles [deg] for [EMIM][AuCl4].

Au(1)-Cl(2)#1	2.279(2)
Au(1)-Cl(2)	2.279(2)
Au(1)-Cl(1)#1	2.280(2)
Au(1)-Cl(1)	2.280(2)
Au(1)-Cl(3)	3.356(3)
Au(2)-Cl(3)	2.267(3)
Au(2)-Cl(3)#2	2.267(3)
Au(2)-Cl(4)	2.281(2)
Au(2)-Cl(4)#2	2.281(2)
N(1)-C(1)	1.319(10)
N(1)-C(2)	1.350(11)
N(1)-C(4)	1.461(10)
N(2)-C(1)	1.329(11)
N(2)-C(3)	1.355(10)
N(2)-C(5)	1.471(10)
C(2)-C(3)	1.335(11)
C(5)-C(6')	1.42(2)
C(5)-C(6)	1.436(17)
Cl(2)#1-Au(1)-Cl(2)	180.0
Cl(2)#1-Au(1)-Cl(1)#1	90.95(6)
Cl(2)-Au(1)-Cl(1)#1	89.05(6)
Cl(2)#1-Au(1)-Cl(1)	89.05(6)
Cl(2)-Au(1)-Cl(1)	90.95(6)
Cl(1)#1-Au(1)-Cl(1)	180.0
Cl(2)#1-Au(1)-Cl(3)	91.01(8)
Cl(2)-Au(1)-Cl(3)	88.99(8)
Cl(1)#1-Au(1)-Cl(3)	88.88(8)
Cl(1)-Au(1)-Cl(3)	91.12(8)
Cl(3)-Au(2)-Cl(3)#2	180.0
Cl(3)-Au(2)-Cl(4)	89.83(9)
Cl(3)#2-Au(2)-Cl(4)	90.17(9)
Cl(3)-Au(2)-Cl(4)#2	90.17(9)
Cl(3)#2-Au(2)-Cl(4)#2	89.83(9)
Cl(4)-Au(2)-Cl(4)#2	180.0
Au(2)-Cl(3)-Au(1)	168.45(12)
C(1)-N(1)-C(2)	108.4(7)
C(1)-N(1)-C(4)	125.3(8)
C(2)-N(1)-C(4)	126.3(8)
C(1)-N(2)-C(3)	107.7(7)
C(1)-N(2)-C(5)	126.1(8)
C(3)-N(2)-C(5)	126.1(8)
N(1)-C(1)-N(2)	108.7(8)
C(3)-C(2)-N(1)	107.5(8)
C(2)-C(3)-N(2)	107.7(8)
C(6')-C(5)-C(6)	50(2)
C(6')-C(5)-N(2)	114(2)
C(6)-C(5)-N(2)	114.7(10)

Symmetry transformations used to generate equivalent atoms:
#1 -x,-y,-z #2 -x+1,-y,-z

Table S4. Anisotropic displacement parameters (A^2 x 10^3) for [EMIM][AuCl4]. The anisotropic displacement factor exponent takes the form: -2 pi^2 [h^2 a*^2 U11 + ... + 2 h k a* b* U12]

	U11	U22	U33	U23	U13	U12
Au(1)	19(1)	14(1)	16(1)	1(1)	4(1)	1(1)
Au(2)	16(1)	27(1)	35(1)	-5(1)	7(1)	2(1)
Cl(1)	56(2)	21(1)	24(2)	9(1)	11(1)	9(1)
Cl(2)	43(2)	21(1)	25(2)	-7(1)	8(1)	-1(1)
Cl(3)	20(1)	90(2)	68(2)	18(2)	16(1)	14(1)
Cl(4)	35(2)	62(1)	37(1)	3(1)	6(1)	5(1)
N(1)	25(5)	32(4)	29(4)	3(3)	3(3)	-3(3)
N(2)	36(5)	28(3)	30(4)	-1(3)	11(4)	-3(3)
C(1)	33(5)	31(5)	32(4)	6(4)	14(4)	9(4)
C(2)	31(6)	45(5)	26(5)	-13(4)	-4(4)	18(4)
C(3)	39(6)	56(6)	25(4)	-5(4)	11(4)	-3(4)
C(4)	59(8)	44(5)	73(8)	32(6)	1(6)	-12(5)
C(5)	68(8)	40(5)	49(6)	15(5)	13(6)	-3(5)
C(6)	60(12)	32(7)	108(14)	17(9)	-24(10)	1(7)
C(6')	90(2)	47(17)	100(2)	1(18)	7(19)	7(17)

Table S5. Hydrogen coordinates (x 10^4) and isotropic displacement parameters (A^2 x 10^3) for [EMIM][AuCl4].

	x	y	z	U(eq)
H(1)	3268	-171	3589	37
H(2)	1485	1967	5637	42
H(3)	972	154	6430	47
H(4A)	2790	2744	3881	90
H(4B)	2869	1953	2536	90
H(4C)	3969	2018	3855	90
H(5A)	1281	-1810	5429	62
H(5B)	2206	-1933	4288	62
H(5A')	1851	-1760	6179	62
H(5B')	1466	-1902	4460	62
H(6A)	2916	-2786	6410	106
H(6B)	2873	-1679	7289	106
H(6C)	3795	-1811	6143	106
H(6A')	3137	-2879	5224	120
H(6B')	3829	-1827	5920	120
H(6C')	3467	-1925	4190	120

Table S6. Crystal data and structure refinement for [BMIM][AuCl4].

Identification code	mh21
Empirical formula	C8 H15 Au C9 N2
Formula weight	477.05
Temperature	193(2) K
Wavelength	0.71073 A
Crystal system, space group	Triclinic, P-1
Unit cell dimensions	a = 7.9354(14) A alpha = 83.94(2) deg. b = 8.3930(15) A beta = 87.93(2) deg. c = 11.397(2) A gamma = 78.04(2) deg.
Volume	738.4(2) A^3
Z, Calculated density	2, 2.146 Mg/m^3
Absorption coefficient	10.194 mm^-1
F(000)	448
Crystal size	0.15 x 0.15 x 0.10 mm
Theta range for data collection	2.62 to 24.14 deg.
Index ranges	-9<=h<=8, -9<=k<=9, -13<=l<=13
Reflections collected / unique	4758 / 2198 [R(int) = 0.0510]
Completeness to 2theta = 24.14	93.2%
Min. max. transmission	0.927/0.484
Refinement method	Full-matrix least-squares on F^2
Data / restraints / parameters	2198 / 107 / 158
Goodness-of-fit on F^2	0.952
Final R indices [I>2sigma(I)]	R1 = 0.0378, wR2 = 0.0931
R indices (all data)	R1 = 0.0443, wR2 = 0.0970
Largest diff. peak and hole	1.494 and -2.583 e.A^-3

Table S7. Atomic coordinates (x 10^4) and equivalent isotropic displacement parameters (A^2 x 10^3) for [BMIM][AuCl4]. U(eq) is defined as one third of the trace of the orthogonalized Uij tensor.

	x	y	z	U(eq)
Au(1)	0	0	0	32(1)
Au(2)	0	0	5000	44(1)
Cl(1)	-204(2)	2739(2)	104(2)	49(1)
Cl(2)	2930(2)	-366(2)	-45(2)	49(1)
Cl(3)	-117(3)	287(4)	3002(2)	89(1)
Cl(4)	2673(3)	-1605(3)	4903(2)	74(1)
N(1)	4547(9)	2684(8)	2202(6)	50(2)
N(2)	5567(9)	4857(7)	1747(6)	51(2)
C(1)	5946(10)	3291(8)	2138(7)	45(2)
C(2)	3820(13)	5221(13)	1557(9)	76(3)
C(3)	3213(14)	3905(17)	1826(11)	78(3)
C(4)	4459(15)	989(11)	2640(9)	75(3)
C(5)	6768(13)	5971(10)	1604(8)	65(2)
C(6)	7820(2)	5870(2)	2742(16)	68(6)
C(7)	6710(3)	6390(3)	3768(16)	76(7)
C(8)	7630(2)	6370(16)	4880(12)	121(5)
C(6')	6780(3)	6870(2)	2701(15)	70(5)
C(7')	7550(4)	5730(2)	3717(17)	90(7)

Table S8. Bond lengths [A] and angles [deg] for [BMIM][AuCl4].

Au(1)-Cl(2)	2.2804(18)
Au(1)-Cl(2)#1	2.2804(18)
Au(1)-Cl(1)	2.2863(17)
Au(1)-Cl(1)#1	2.2863(17)
Au(1)-Cl(3)	3.452(3)
Au(2)-Cl(3)#2	2.267(3)
Au(2)-Cl(3)	2.267(3)
Au(2)-Cl(4)#2	2.271(2)
Au(2)-Cl(4)	2.271(2)
N(1)-C(1)	1.311(10)
N(1)-C(3)	1.358(12)
N(1)-C(4)	1.471(10)
N(2)-C(1)	1.319(9)
N(2)-C(2)	1.376(11)
N(2)-C(5)	1.461(11)
C(2)-C(3)	1.298(16)
C(5)-C(6')	1.530(18)
C(5)-C(6)	1.56(2)
C(6)-C(7)	1.48(2)
C(7)-C(8)	1.48(2)
C(8)-C(7')	1.49(2)
C(6')-C(7')	1.49(2)
Cl(2)-Au(1)-Cl(2)#1	180.0
Cl(2)-Au(1)-Cl(1)	89.75(7)
Cl(2)#1-Au(1)-Cl(1)	90.25(7)
Cl(2)-Au(1)-Cl(1)#1	90.25(7)
Cl(2)#1-Au(1)-Cl(1)#1	89.75(7)
Cl(1)-Au(1)-Cl(1)#1	180.0
Cl(2)-Au(1)-Cl(3)	91.22(7)
Cl(2)#1-Au(1)-Cl(3)	88.78(7)
Cl(1)-Au(1)-Cl(3)	77.30(8)
Cl(1)#1-Au(1)-Cl(3)	102.70(8)
Cl(3)#2-Au(2)-Cl(3)	180.0
Cl(3)#2-Au(2)-Cl(4)#2	89.90(9)
Cl(3)-Au(2)-Cl(4)#2	90.10(9)
Cl(3)#2-Au(2)-Cl(4)	90.10(9)
Cl(3)-Au(2)-Cl(4)	89.90(9)
Cl(4)#2-Au(2)-Cl(4)	180.0
Au(2)-Cl(3)-Au(1)	170.00(13)
C(1)-N(1)-C(3)	107.8(8)
C(1)-N(1)-C(4)	125.3(7)
C(3)-N(1)-C(4)	126.9(9)
C(1)-N(2)-C(2)	106.0(8)
C(1)-N(2)-C(5)	126.1(7)
C(2)-N(2)-C(5)	127.9(8)
N(1)-C(1)-N(2)	109.8(7)
C(3)-C(2)-N(2)	108.7(9)
C(2)-C(3)-N(1)	107.7(10)
N(2)-C(5)-C(6')	111.5(10)
N(2)-C(5)-C(6)	111.2(9)
C(6')-C(5)-C(6)	39.6(10)
C(7)-C(6)-C(5)	112.3(14)
C(8)-C(7)-C(6)	115.7(16)
C(7)-C(8)-C(7')	30.2(11)
C(7')-C(6')-C(5)	111.0(12)
C(6')-C(7')-C(8)	119.0(15)

Symmetry transformations used to generate equivalent atoms:
#1 -x,-y,-z #2 -x,-y,-z+1

Table S9. Anisotropic displacement parameters (A^2 x 10^3) for [BMIM][AuCl4]. The anisotropic displacement factor exponent takes the form: -2 pi^2 [h^2 a*^2 U11 + ... + 2 h k a* b* U12]

	U11	U22	U33	U23	U13	U12
Au(1)	29(1)	38(1)	29(1)	0(1)	-1(1)	-8(1)
Au(2)	43(1)	52(1)	36(1)	10(1)	-3(1)	-14(1)
Cl(1)	49(1)	39(1)	60(1)	-4(1)	-2(1)	-10(1)
Cl(2)	29(1)	60(1)	58(1)	-6(1)	-1(1)	-10(1)
Cl(3)	70(2)	138(2)	42(1)	8(1)	-2(1)	7(2)
Cl(4)	58(1)	84(2)	65(2)	14(1)	2(1)	5(1)
N(1)	44(4)	64(4)	47(4)	-7(3)	-2(3)	-20(3)
N(2)	53(4)	53(4)	46(4)	1(3)	-4(3)	-10(3)
C(1)	44(4)	40(3)	49(5)	1(3)	-4(4)	-8(3)
C(2)	63(6)	81(6)	76(7)	9(5)	-28(5)	0(5)
C(3)	47(6)	113(9)	73(8)	2(7)	-15(5)	-14(6)
C(4)	102(8)	75(6)	64(6)	-11(5)	9(5)	-53(6)
C(5)	86(7)	58(4)	57(6)	-3(4)	13(5)	-32(4)
C(6)	71(12)	59(10)	79(13)	-23(10)	35(11)	-29(9)
C(7)	99(16)	69(12)	62(12)	-17(11)	26(12)	-22(11)
C(8)	158(13)	121(9)	101(10)	-49(8)	6(9)	-52(9)
C(6')	84(12)	50(9)	77(12)	-8(8)	27(10)	-19(8)
C(7')	111(16)	74(12)	89(14)	-13(11)	-22(13)	-24(11)

Table S10. Hydrogen coordinates (x 10^4) and isotropic displacement parameters (A^2 x 10^3) for [BMIM][AuCl4].

	x	y	z	U(eq)
H(1)	7067	2692	2343	54
H(2)	3166	6263	1275	91
H(3)	2046	3812	1770	94
H(4A)	3268	845	2606	113
H(4B)	4852	760	3457	113
H(4C)	5200	233	2147	113
H(5A)	6118	7106	1417	78
H(5B)	7566	5687	935	78
H(5'A)	6435	6780	912	78
H(5'B)	7942	5341	1452	78
H(6A)	8460	4733	2931	81
H(6B)	8678	6581	2597	81
H(7A)	6047	7510	3557	91
H(7B)	5877	5658	3912	91
H(8A)	6787	6734	5499	181
H(8B)	8437	7110	4759	181
H(8C)	8256	5257	5118	181
H(8'A)	6468	6597	5235	181
H(8'B)	8070	7382	4765	181
H(8'C)	8390	5555	5403	181
H(6'A)	7459	7739	2530	84
H(6'B)	5590	7401	2905	84
H(7'A)	8735	5220	3488	108
H(7'B)	6888	4839	3836	108