

Supporting Information for:

Facile Synthesis of Colloidal Lead Halide Perovskite  
Nanoplatelets via Ligand-Assisted Reprecipitation

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Nanoplatelets	PLQY
$n = 1$ PbBr	< 0.1 %
$n = 2$ MAPbBr	6.8 %
$n = 2$ FAPbBr	5.8 %
$n = 1$ PbI	0.2 %
$n = 2$ MAPbI	0.9 %
$n = 2$ FAPbI	0.7 %

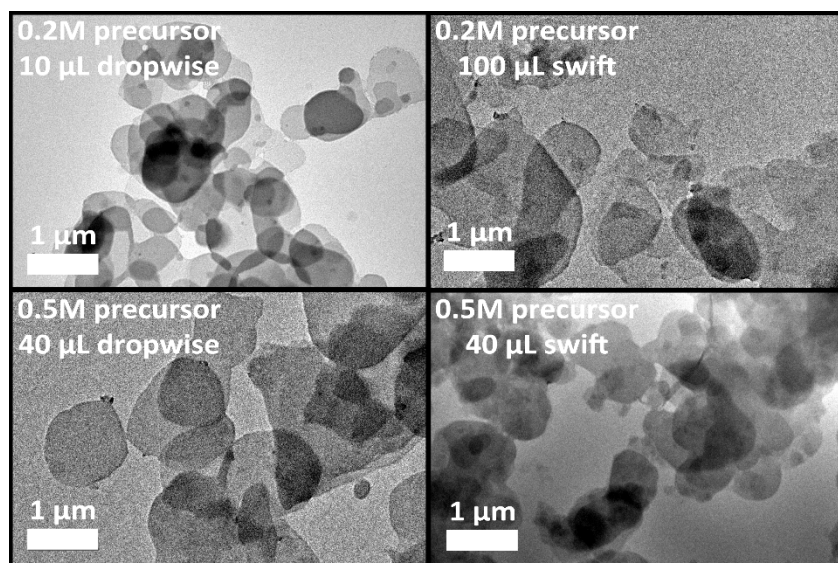
**Table S1.** Photoluminescence quantum yields (PLQY) of as-synthesized colloidal perovskite nanoplatelets in toluene.

Note: Samples were excited using a 405 nm LED (Thorlabs) except  $n = 1$  PbBr.  $n = 1$  PbBr nanoplatelet solution was excited using a 365 nm LED (Thorlabs), but sample emission peak was too weak and below the detection limit of the setup.

Nanoplatelets	Ligands	MABr	PbBr <sub>2</sub>	BABr	HABr	OABr	DDABr	i-PABr
$n=1$ PbBr	<i>butylamine</i>	0	1	2	0	0	0	0
$n=1$ PbBr	<i>hexylamine</i>	0	1	0	2	0	0	0
$n=1$ PbBr	<i>octylamine</i>	1	1	0	0	2	0	0
$n=1$ PbBr	<i>dodecylamine</i>	0	1	0	0	0	2	0
$n=1$ PbBr	<i>isopentylamine</i>	0	1	0	0	0	0	2
$n=1$ PbBr	<i>butylamine + octylamine</i>	0	1	1	1	0	0	0
$n=2$ MAPbBr	<i>butylamine</i>	1	2	3	0	0	0	0
$n=2$ MAPbBr	<i>hexylamine</i>	1	2	0	5	0	0	0
$n=2$ MAPbBr	<i>octylamine</i>	1	2	0	0	10	0	0
$n=2$ MAPbBr	<i>dodecylamine</i>	1	2	0	0	0	5	0
$n=2$ MAPbBr	<i>isopentylamine</i>	1	2	0	0	0	0	5
$n=2$ MAPbBr	<i>butylamine + octylamine</i>	1	2	5	5	0	0	0

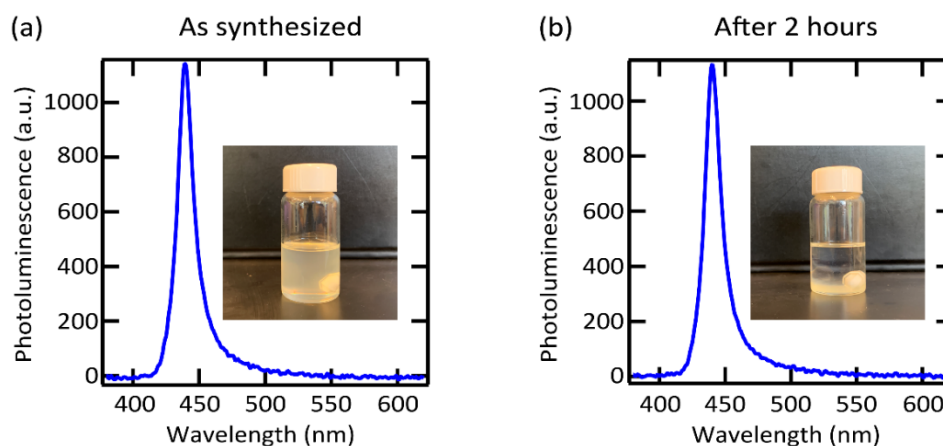
**Table S2.** Formulation guidelines for perovskite nanoplatelet precursor solutions with different ligand species. Numbers in the table indicate the volumetric equivalents of each precursor solutions (columns) that should be combined to achieve the targeted nanoplatelets (rows), according to the concentration specifications in the protocol text.

Abbreviations: MABr: methylammonium bromide, PbBr<sub>2</sub>: lead bromide, BABr: butylammonium bromide, HABr: hexylammonium bromide, OABr: octylammonium bromide, DDABr: dodecylammonium bromide, i-PABr: isopentylammonium bromide



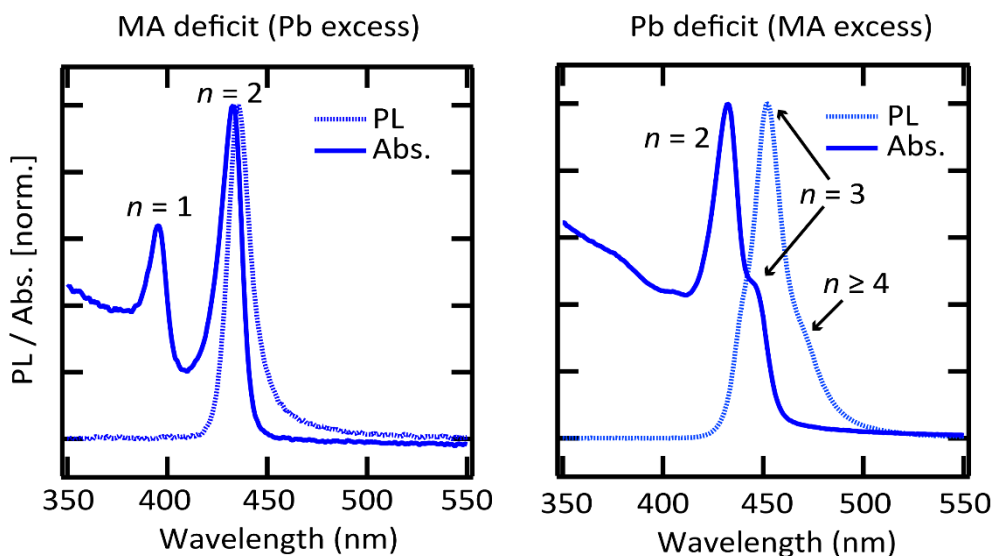
**Figure S1.** Transmission electron microscopy (TEM) images of  $n = 2$  MAPbBr nanoplatelets synthesized by different injection methods with varying amounts of precursor solution.

- ‘0.2M and 0.5M precursor’ refer to MABr:PbBr<sub>2</sub>:BABr:OABr = 1:2:5:5 mixture of 0.2M and 0.5M individual (MABr, PbBr<sub>2</sub>, BABr and OABr) precursor solutions, respectively. For dropwise and swift injection of precursor solution, a pipette and a syringe was used, respectively.  $n = 2$  MAPbBr nanoplatelets synthesized by different injection methods with varying amounts of precursor solutions did not show noticeable differences in their shape, size and polydispersity.



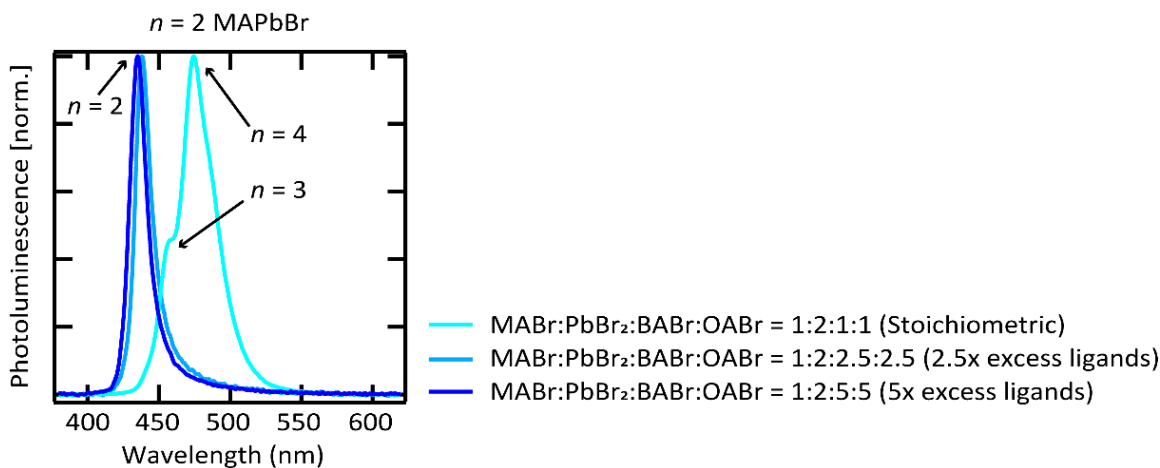
**Figure S2.** Photoluminescence spectra of (a) as-synthesized  $n = 2$  MAPbBr nanoplatelet solution and (b) after nanoplatelet precipitation and redispersion. (Insets: Images of (a) as-synthesized and (b) precipitated perovskite nanoplatelet solutions.)

- To maximize the visibility of nanoplatelet precipitation, 100  $\mu$ L of 0.2M precursor solution, instead of standard 10  $\mu$ L, was injected dropwise into 10 mL toluene for this experiment. PL spectrum taken from redispersed solution after precipitation still showed quantum-confined  $n = 2$  MAPbBr nanoplatelet emission with the same intensity and confirmed that precipitation occurred due to the aggregation of the nanoplatelets instead of bulk (3D) perovskite formation.



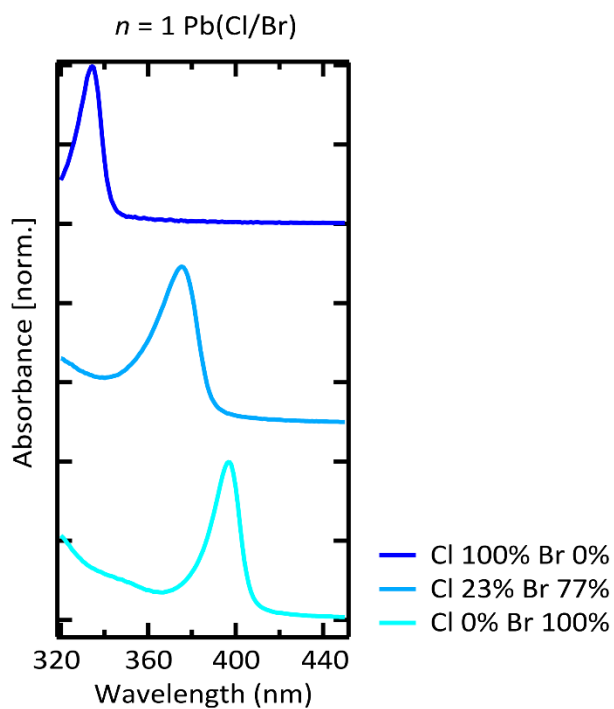
**Figure S3.** Example photoluminescence and absorption spectra of MA-deficit and Pb-deficit attempts on synthesizing  $n = 2$  MAPbBr nanoplatelets.

- MA and Pb deficit (Compared to the stoichiometric ratio of  $\text{MABr}:\text{PbBr}_2 = 1:2$  for  $n = 2$  MAPbBr nanoplatelets) resulted in the formation of thinner and thicker nanoplatelets, respectively, along with intended  $n = 2$  MAPbBr nanoplatelets.

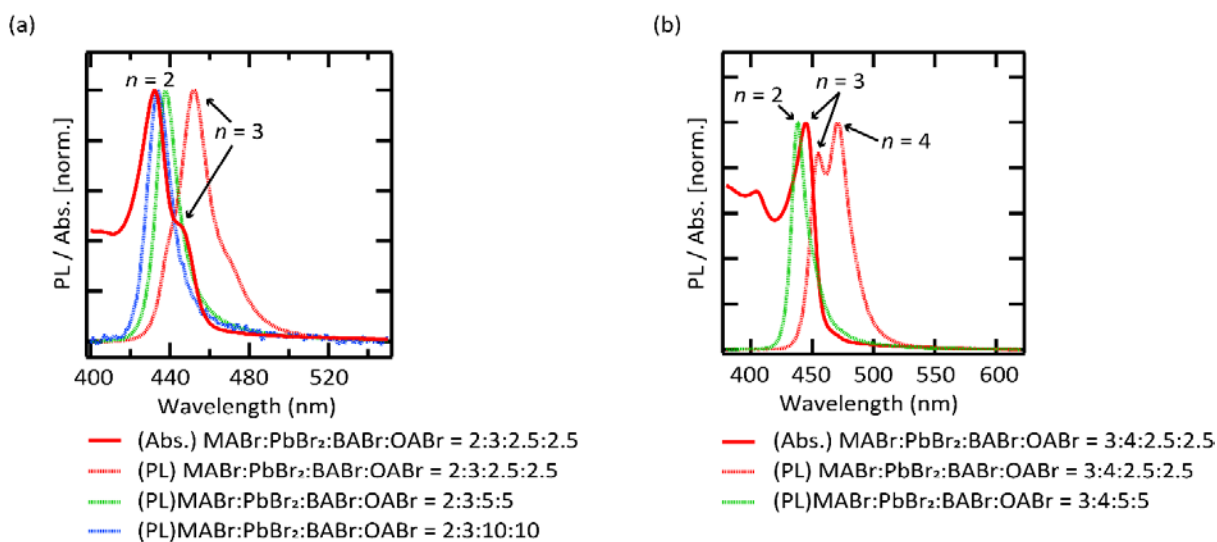


**Figure S4.** Necessity of adding excess ligands in the precursor solution for precise thickness control.

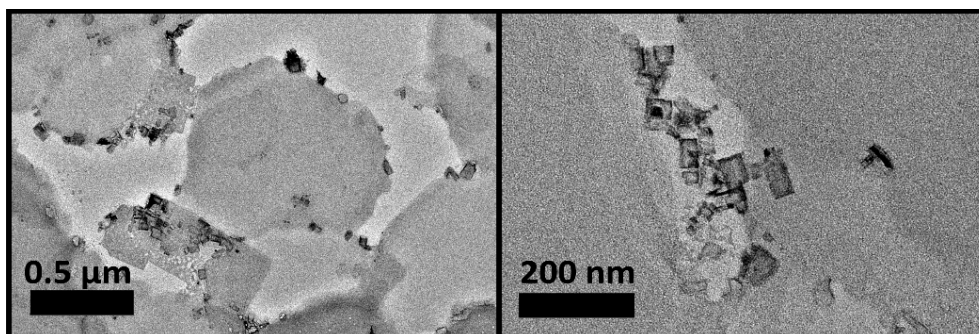
- Presence of excess ligands in the precursor solution was proven to be crucial to prevent the formation of thicker nanoplatelets and ensure thickness homogeneity of the system.



**Figure S5.** Normalized absorption spectra of  $n = 1$  Pb(Cl/Br) nanoplatelet solutions.

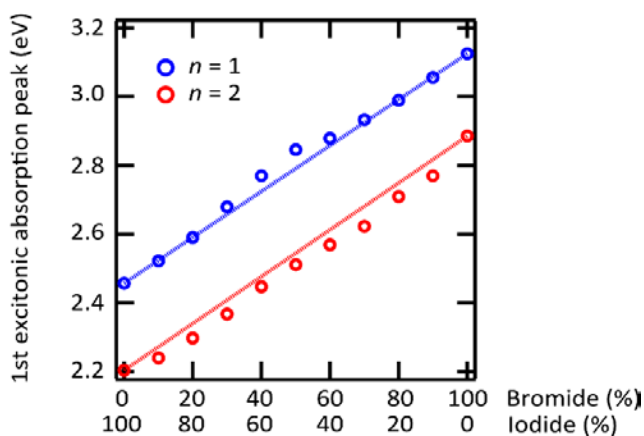


**Figure S6.** Unsuccessful attempts on the synthesis of (a)  $n = 3$  and (b)  $n = 4$  MAPbBr nanoplatelets.

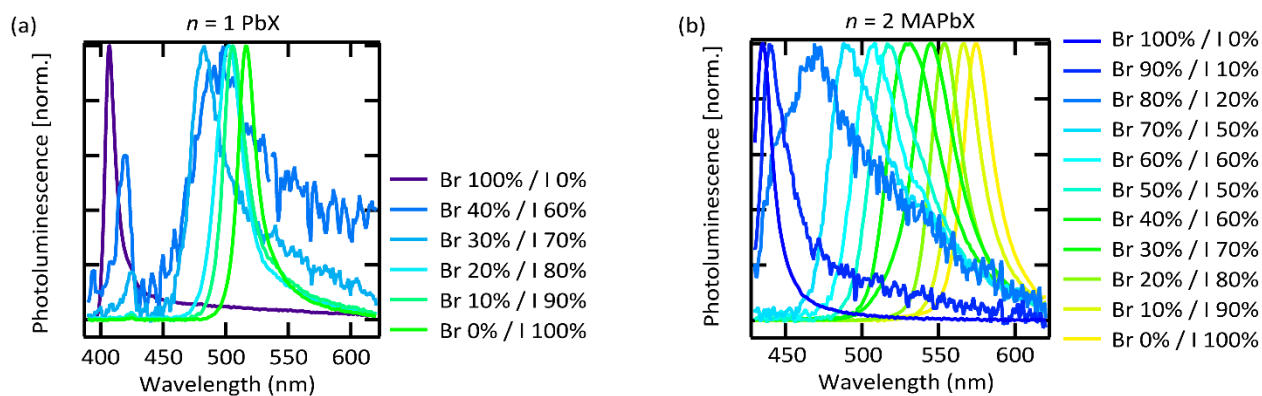


**Figure S7.** Transmission electron microscopy (TEM) images of  $n = 2$  FAPbBr nanoplatelets.

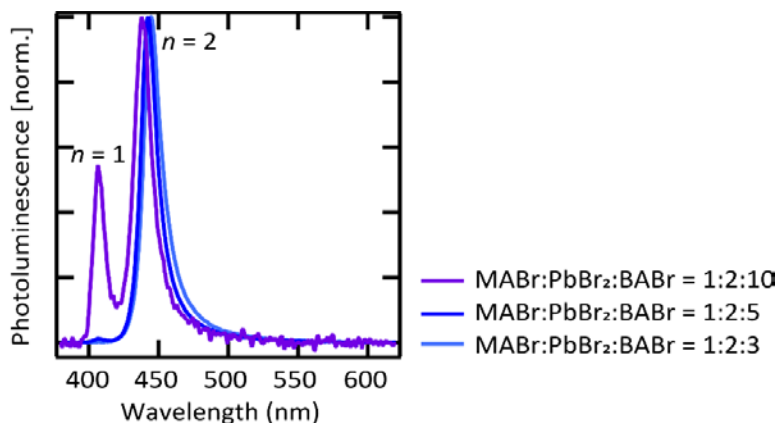
- Dot-like structures observed in  $n = 2$  FAPbBr TEM image in Figure 4 seemed to be smaller nanoplatelets.



**Figure S8.** First excitonic absorption peak energy as a function of halide composition in the precursor solution for  $n = 1$  PbX and  $n = 2$  MAPbX nanoplatelets. Dotted lines show the straight line between bromide-only and iodide-only nanoplatelet excitonic absorption energies.

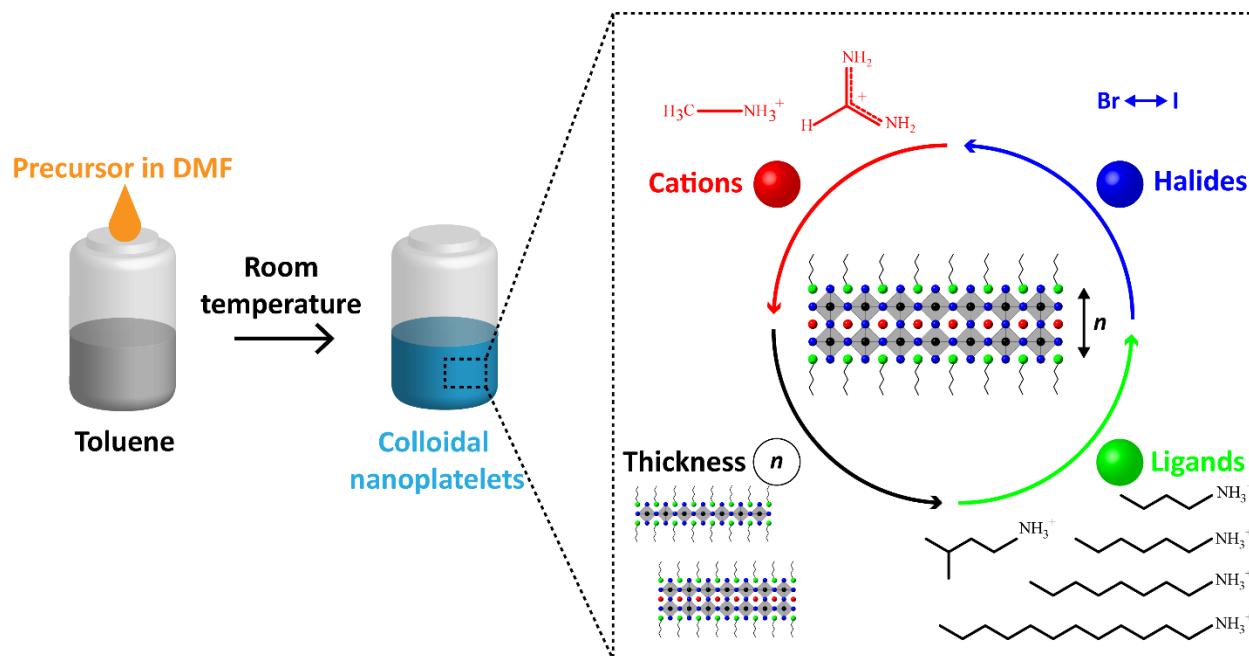


**Figure S9.** Normalized photoluminescence spectra of colloidal (a)  $n = 1$  PbX and (b)  $n = 2$  MAPbX perovskite nanoplatelet solutions with mixed halides.



**Figure S10.** Normalized photoluminescence spectra of colloidal lead bromide perovskite nanoplatelet solution with varying amounts of butylammonium bromide ligands added in the precursor solution.

- When butylammonium was employed as the only ligand species in the system, standard ratio of MABr:PbBr<sub>2</sub>:LBr = 1:2:10 (L: ligands) resulted in the formation of both  $n = 1$  and  $n = 2$  nanoplatelets. Ratio had to be modified to MABr:PbBr<sub>2</sub>:LBr = 1:2:3 to retain the thickness purity in the system. In general, when new ligand species is employed, it is likely that the relative amount of ligands in the precursor solution may need to be slightly adjusted for precise thickness control.



**Figure S11.** Schematic illustration of the synthetic protocol and its universal applicability in synthesizing colloidal lead halide perovskite nanoplatelets with various thicknesses and compositions.