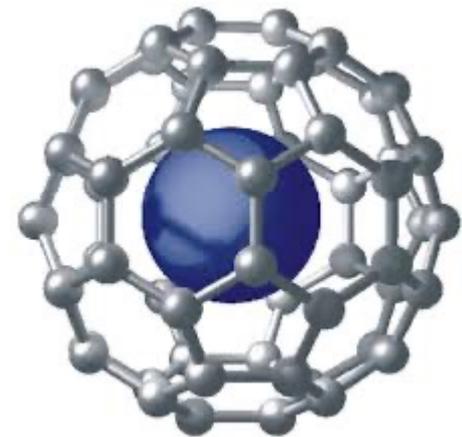

DESIGNER CARBON MATERIALS LTD

PROF KYRIAKOS PORFYRAKIS FRSC

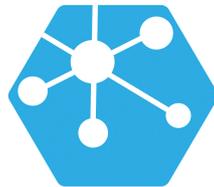


WHAT ARE ENDOHEDRAL FULLERENES?

- Fullerenes are spherical molecules consisting entirely of carbon atoms. They were discovered in 1985.
- The most well known fullerenes are C_{60} and C_{70}
- Fullerenes larger than C_{70} are usually referred to as “higher fullerenes”
- An endohedral fullerene (“**EF**”) is the same spherical carbon cage structure which other atom(s) or ion(s) inside the shell.
- The incarcerated atom(s) give the EF highly desirable chemical properties that have a broad range of potential uses.
- **To date, nobody else can** produce specific and large quantities of higher fullerenes and EFs with a specified species inside the carbon shell.



DESIGNER CARBON MATERIALS



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MATERIALS



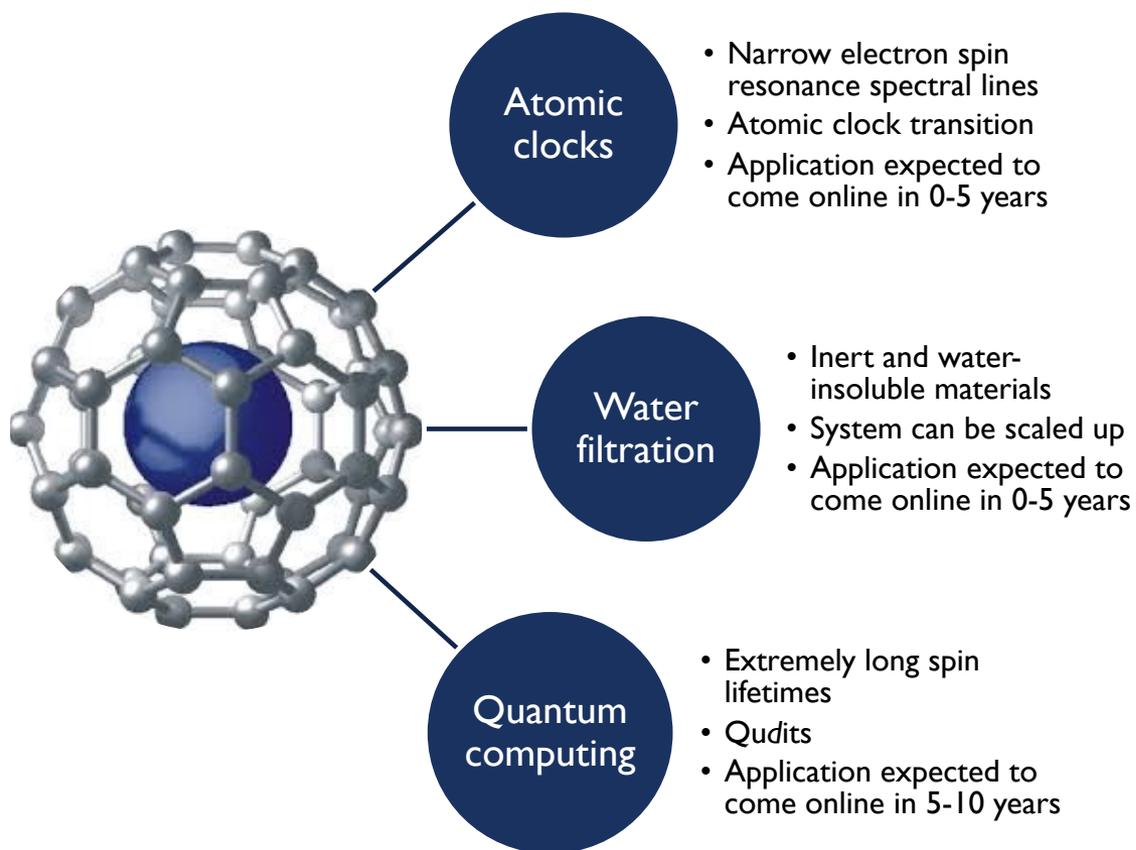
oxford
technology

Incorporated in 2014

NEW STATE-OF-THE-ART LABS IN 2022!

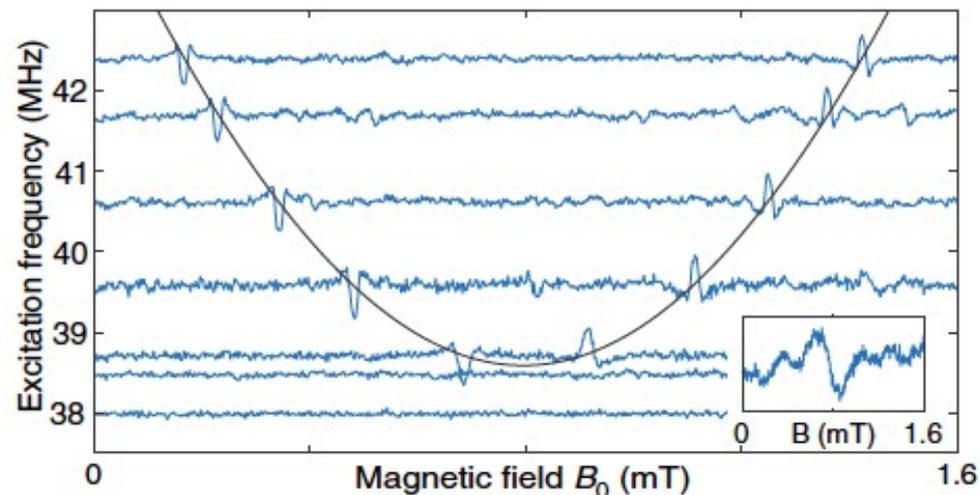


MARKET POTENTIAL



ATOMIC CLOCKS

- Use of endohedral fullerenes for miniaturised atomic clocks
- Collaboration with Locator-X for development of atomic clocks
- Demonstrated clock transition at 38.474 MHz that is independent of magnetic field
- We can improve SNR by a factor of ~ 200 by using higher purity material and also other species such as: $P@C_{60}$.



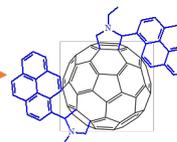
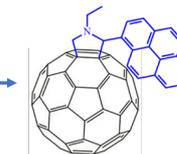
WATER FILTERS

- Fullerenes combined with carbon nanotubes and/or graphene can make excellent water filters
- Advantages over conventional filters:
 - The filter not only separates physically any impurities but it also destroys pathogens under UV light irradiation
 - Technology versatile to be used both in small portable applications or even in large scale water tanks (very useful in developing countries)
- Patent in preparation
- Water filters market > USD 30 Billion, expected to grow to USD 58 Billion by 2025

WATER FILTERS

- Progress:
- Light irradiation of fullerene derivatives causes the release of reactive oxygen species (ROS) in water that can destroy pathogens

No.	Composites	Amount of Graphene Materials Added [mg]	Amount of Fullerene Materials Added [mg]	MB decomposed in 1h full-band light shining [mg]	Decomposition rate [mg MB/(mg fullerene * h)]
*	1% C₆₀/AA Gra IPA	3	0.030	0.0174	0.5800
1	1% C ₆₀ /GO-10mg KMnO ₄	3	0.030	0.0429	1.4300
2	1% C ₆₀ /GO-20mg KMnO ₄	3	0.030	0.0551	1.8367
3	1% C ₆₀ /GO-30mg KMnO ₄	3	0.030	absorbance reached zero before 60 min	
4	1% C ₆₀ /GO-40mg KMnO ₄	3	0.030	absorbance reached zero before 60 min	
*	1% mono-C60ETH/AA Gra IPA	3	0.039	0.0138	0.3538
5	1% mono-C60ETH/GO-10mg KMnO ₄	3	0.039	0.0448	1.1487
6	1% mono-C60ETH/GO-20mg KMnO ₄	3	0.039	0.0528	1.3538
7	1% mono-C60ETH/GO-30mg KMnO ₄	3	0.039	absorbance reached zero before 60 min	
8	1% mono-C60ETH/GO-40mg KMnO ₄	3	0.039	absorbance reached zero before 60 min	
*	1% bis-C60ETH/AA Gra IPA	3	0.052	0.0281	0.5404
9	1% bis-C60ETH/GO-10mg KMnO ₄	3	0.052	0.0382	0.7346
10	1% bis-C60ETH/GO-20mg KMnO ₄	3	0.052	0.0507	0.9750
11	1% bis-C60ETH/GO-30mg KMnO ₄	3	0.052	absorbance reached zero before 60 min	
12	1% bis-C60ETH/GO-40mg KMnO ₄	3	0.052	absorbance reached zero before 60 min	



Commercial anatase TiO₂ decomposition rate is 0.1302 [mg MB/(mg TiO₂ * h)]

MOLECULAR QUANTUM COMPUTING

- Very long spin coherence times (0.25-0.5 ms)
- **Recent Breakthrough:** multilevel qudit systems!



Forschungsartikel

Angewandte
 Chemie
 www.angewandte.org



Molecular Qudits

Zitierweise: *Angew. Chem. Int. Ed.* **2022**, 61, e202115263

Internationale Ausgabe: doi.org/10.1002/anie.202115263

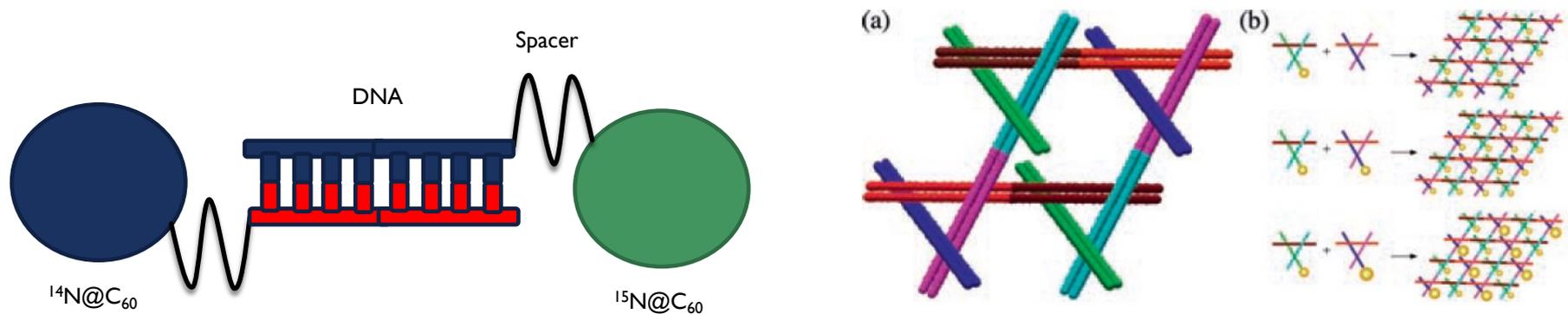
Deutsche Ausgabe: doi.org/10.1002/ange.202115263

Implementation of Quantum Level Addressability and Geometric Phase Manipulation in Aligned Endohedral Fullerene Qudits

Shen Zhou⁺, Jiayue Yuan⁺, Zi-Yu Wang, Kun Ling, Peng-Xiang Fu, Yu-Hui Fang, Ye-Xin Wang, Zheng Liu, Kyriakos Porfyrakis, G. Andrew D. Briggs, Song Gao, and Shang-Da Jiang**

MOLECULAR QUANTUM COMPUTING

- Molecular quantum roadmap using Nature's building blocks
- Ordering fullerenes via DNA self assembly
- Coherently manipulate a multi qudit spin system
- Application of Grover's quantum algorithm



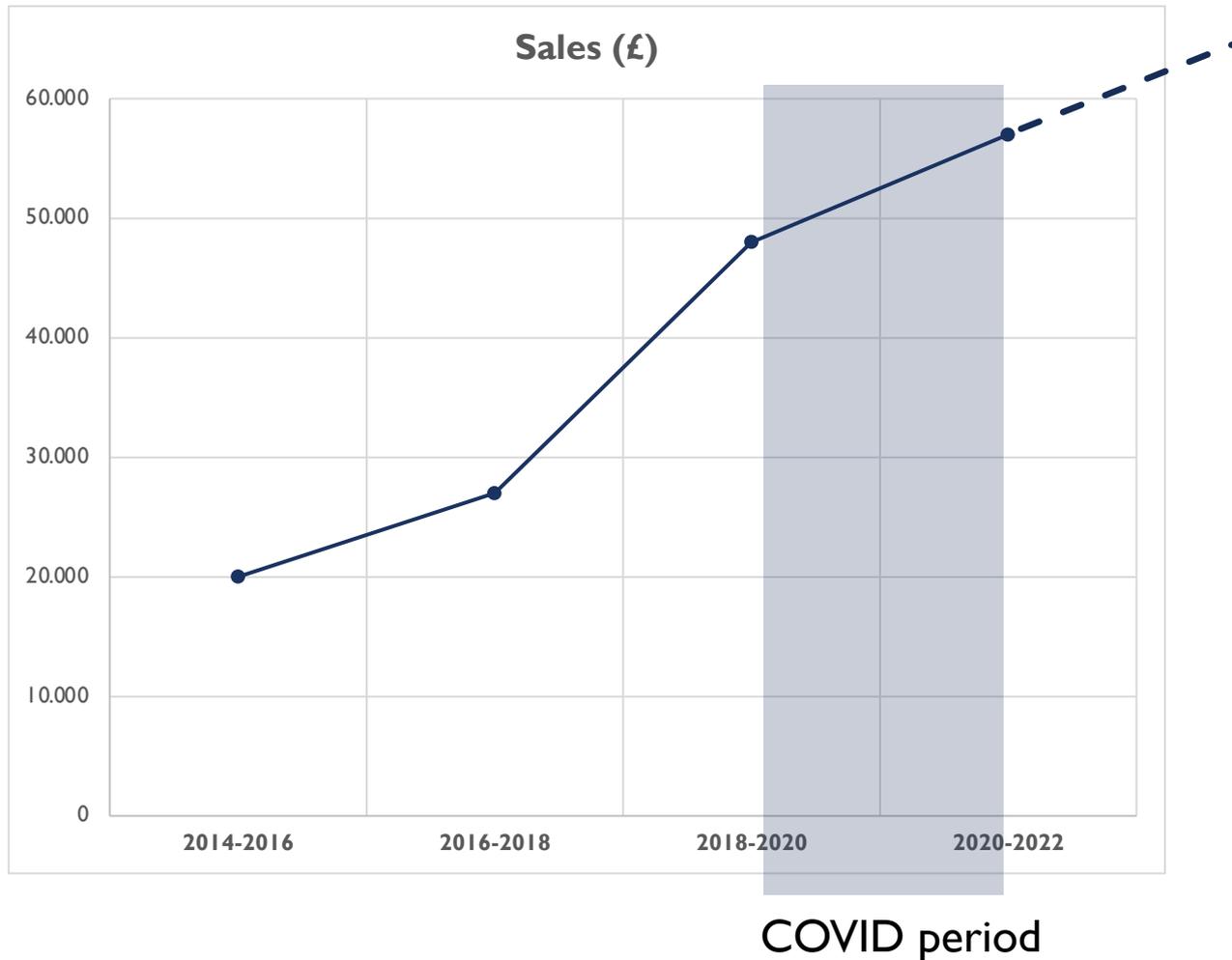
■CONFIDENTIAL



3-4 years

■10

SALES RECORD



INVESTMENT SOUGHT

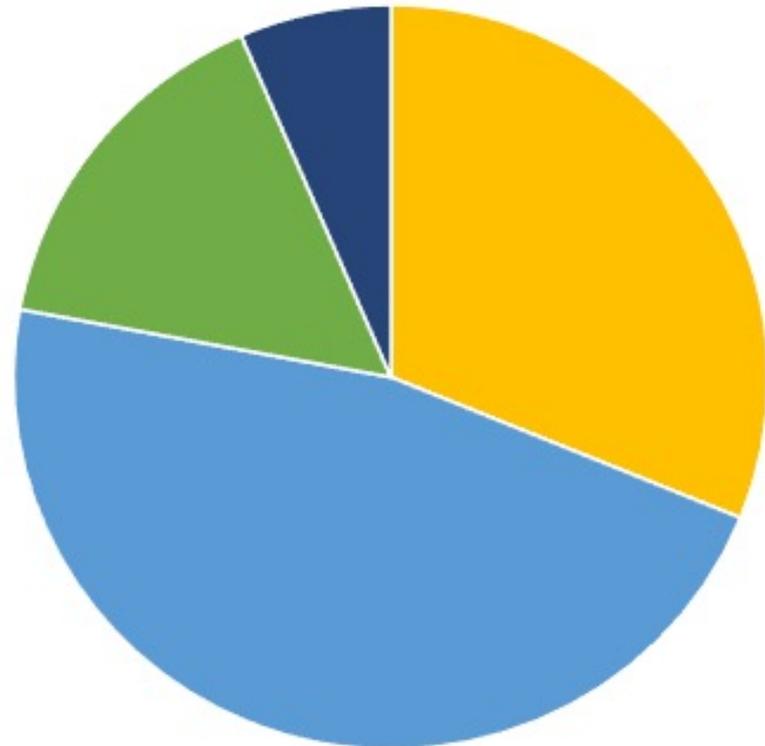
- We are looking for investment in company shares from investors, business angels etc for up to £100,000 to be used for:
 - £50,000 for company overheads, fees, patent costs for 1-2 years
 - £30,000-£60,000 to hire a scientist for continuous production of materials for up to 2 years for current and foreseeable company sales
 - £40,000 as contribution to an Innovate UK Smart grant worth £130,000 (70% state funding) for further development of a glow discharge reactor for the production of endohedral fullerenes

PROJECTED REVENUE

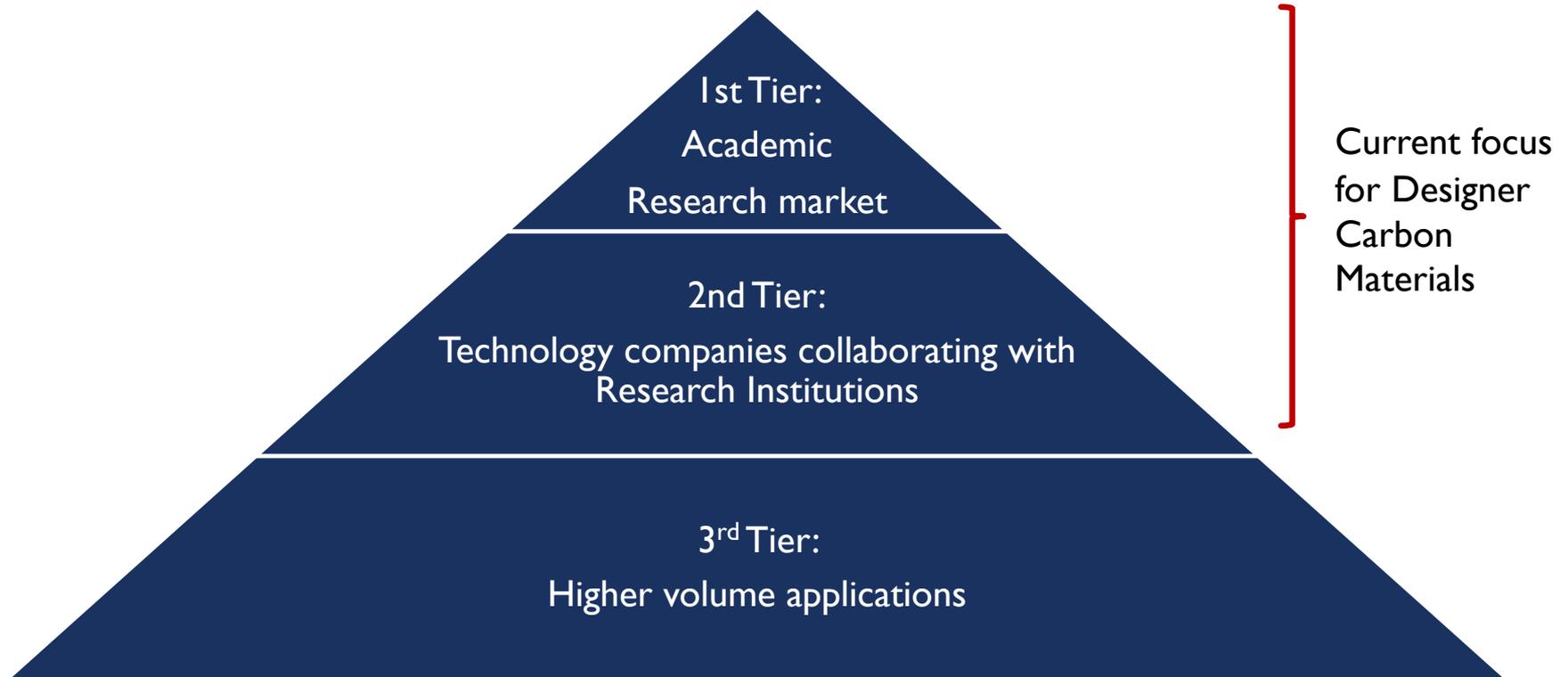
- Year 1:
 - £57,000 (orders in place)
- Year 2:
 - £60,000 (higher purity materials need for one or more of the 3 applications described)
- Year 3:
 - £100,000-£500,000 (We expect progress in the atomic clock technology to warrant scale-up production of higher purity materials)

DCM LTD. CAP TABLE

- Founder: 31.17%
- University of Oxford: 46.75%
- OT(S)EIS: 15.58%
- Private Investor: 6.5%



TARGET MARKETS



COMPETITION

- Bucky-USA and S.E.S. Research (both US-based) are the only companies that sell some types of EFs using different technology.
- But none of these companies can produce N@C₆₀ fullerenes and their derivatives.
- Also none of these companies can produce bespoke EFs in the amounts and purities as generated by DCM Ltd.

We are world-leaders when it comes to N@C₆₀

FIND US AT:



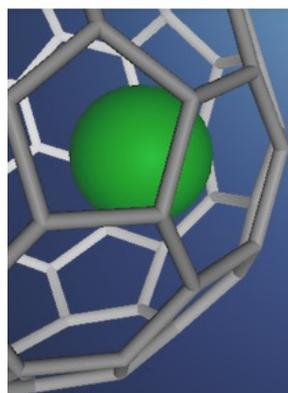
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Next generation carbon nanomaterials for science and industry

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